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[OFFICIAL NOTICE.]

American Gas Light Association.

"SEC. 51. *No member who owes two years' dues shall be entitled to vote, or to participate in the deliberations of the Association, or to receive a copy of the proceedings.*"

This provision of the Constitution will be enforced at the coming meeting.

PHILADELPHIA, PA., Sept. 1, 1891.

Mr.....

The practice established a year or two since of collecting dues in advance of meeting has operated as expected, in facilitating the transaction of business at the meetings. It is especially necessary that this course should be followed this year.

Remittance may be made by check, post office order, registered letter, or by express. Address Drexel Building, Philadelphia.

The amount of yearly dues is shown below.

Attention to many matters, including the sending out of these notices, has been delayed by the long illness of the Secretary. By giving this your immediate attention you will assist in straightening out matters, and you will confer a favor upon

Yours truly,
ALEX. C. HUMPHREYS,
Acting Sec. and Treas.

Dues for year ending Sept. 30, 1892, $5.

[OFFICIAL NOTICE.]

Nineteenth Annual Meeting of the American Gas Light Association.

EXTRACT FROM THE CONSTITUTION.—"SEC. 12. *Application for Active Membership, or for Associate Membership, or for transfer from Associate to Active Membership, must be received by the Secretary at least ten days prior to the meeting at which the application is acted on.*"

SECRETARY'S OFFICE, Sept. 9th, 1891.

Dear Sir—This circular is sent to many members of the gas fraternity who are not on our roll of membership; it is done with the object of pressing upon their attention the question of applying for membership in the Association. In these days of sharp competition, no gas man can, in my opinion, afford to remain outside of the Association.

Particular attention is called to Sec. 12 of the Constitution, as shown above.

The application calls for the endorsement of two active members. This should be borne in mind in connection with the Constitutional requirement above quoted, namely: That the *completed* application must be in the hands of the Secretary 10 days in advance of the meeting. Parties applying for admission will of course be welcome at the coming New York meeting, which is set for October 21, 22 and 23.

All correspondence, in regard to application for membership, should be addressed to me at Drexel Building, Philadelphia.

Yours truly, ALEX. C. HUMHHREYS,
Acting Secretary.

Drexel Building, Philadelphia, Pa.

BRIEFLY TOLD.

OUR CURRENT OFFICIAL CIRCULARS.—With this issue we publish two circulars from the Acting Secretary of the American Gas Light Association, copies of which have been mailed to the members, who have had sufficient time to look over them carefully. We desire, however, to emphazise the matters referred to in them, by here calling attention to their suggestions. No doubt many members of the Association feel that it is somewhat out of line to be called upon to pay their yearly dues prior to the meeting, but this year the payments so made will greatly assist the Acting Secretary in carrying out his other duties; for it is no trifling thing to be called upon so hurriedly to assume charge of the details of an office that are always many and often intricate. In any event, no particularly undue hardship is involved in forwarding the dues a month or so in advance of the date at which the payment becomes obligatory. Further, the Acting Secretary advises the members that this course will assist him in "straightening out matters;" and that intimation should in itself be sufficient to cause a ready response to his call. Those whose easy going ways have prevented them from forwarding their dues for a matter of two years or more might also do well to bear in mind the fact that Section 51 of the Constitution of the Association will be enforced at the nineteenth annual meeting.

The other circular refers to applications for membership, which must be made to the Secretary, in complete form, at least 10 days prior to the calling to order of the meeting. The form of obtaining membership is simple enough, and those who contemplate joining should see to it at once that their desire is not frustrated through inadvertence or neglect.

THE WORK OF THE COMMITTEE OF ARRANGEMENTS.—The local committee of arrangements are working with vigor and precision to complete the outing time of the Association, and it is not saying too much to assert that the Committee are preparing for a pleasuring programme that will be most enjoyable. New York in October is usually at her best, and those who visit here with us next month will not lack of opportunity for sight seeing and amusement. One trouble there is which is traceable to the great influx of visitors to the city during October and November. Not one of the largest hotels will guarantee accommodations for a stated number of guests, say in excess of 100, but as the headquarters of the Association—the Holland House—are the very heart of the hotel district, admitting of a wide range for selection, both in respect to personal choice and the thickness of one's wallet, all can be accommodated without placing any materially far from the point of headquarters. We shall, of course, in ample time post our readers as to what the Committee of Arrangements have decided upon for the entertainment of the members and their guests.

THE HALL PROCESS.—In this number of the JOURNAL will be found an instalment of correspondence from the West, by our special correspondent, "Sunset," who, among other things, has been looking up the "Hall Process," respecting the merits of which great things have been said in the daily press. This "process" has been spoken of in the JOURNAL at other times—never, though, has it been mentioned seriously, since it would be impossible to speak of it in a vein that would accord to it any merit other than that which attaches to the career of a soap bubble. "Sunset" dissects it very cleverly and very accurately, and while the "exploiters" may bamboozle some of the verdant Western capitalists into purchasing "State rights," it can be taken for granted that the gas makers of the Western country will have none of it in their's—nor any of their's in it. We hope the heavy-weight mentioned by "Sunset" as having been the recipient of a block of stock in the securities (?) of the Chicago Smokeless Fuel Gas Company will finally succeed in disposing of the same to the Manager of the aforesaid Smokeless, etc., Company. Our heavy-weight would then, indeed, have achieved a great feat, as Manager Hall ought to know to a dot just what the shares are worth. In the meantime we hold ourselves in readiness to put a value on the same, provided there is a difference of opinion regarding their worth between the heavy-weight and the Manager.

The Market for Gas Securities.

The market during the week showed no change of moment. Consolidated sold up to 99¼ on small sales, and the par mark as a permanency will soon be reached. Other city shares, notably Equitable, are also strong and higher. Brooklyn shares show no change, the difference in quotations for Nassau not being founded on anything but the fancy of bidders, as no stock whatever is offered for sale. Chicago gas is strong and active, and Laclede is still being "pegged." There is no change in the general situation.

SPECIAL WESTERN CORRESPONDENCE.

By SUNSET.

Dear JOURNAL:—It is a poor month that does not produce in the West some gas matter of more than usual interest. Whether it is the result of alleged "greater enterprise," or purely the result of expanse of territory in which to exploit, I know not; but suffice it is, we are rarely at a loss for matters of interest.

The all-pervading topic at present in Chicago is of course the new Economic Company. Is it a *bona fide* intention to establish a new Company, in the belief that Chicago is large enough to support another, after the order of several Companies in New York city, or is it a colossal bluff? Local opinion is divided. The *Tribune* leads in recognizing the fact that no more capitalization is wanted or needed in Chicago, and in espousing the cause of the old companies it fairly bristles daily with leaders, squibs, and articles against the new Company. I am bound to say, too, that its logic is correct and its arguments remarkably right for a daily paper, in an attempt to dabble with the gas industry. To illustrate its points, plans of pipes in streets, cross sectional views of sewers, conduits, pipes and cables have been shown, and no stone has been left unturned to show up the needlessness of another Company.

But what is logic against boodle? The Economic has its charter, its permits for street work and tunnel under the Calumet river, and 80 miles of pipe contracted for. The heart of the financial center has been attacked, and the streets are occupied by the new Company's gangs.

The old Companies are hitting back by proceedings against the Economic's backers for suddenly discovered "misappropriation" of $7,500,000 in former deals; and there you are. A pretty fight, indeed, and all the gas men in Chicago are curious to see how it will all end.

Interviews with Manager Yuille must be intresting, according to an account in a recent local paper. It wound up by saying, "And Mr. Yuille emphasized his remarks by pounding on his desk so vigorously that his pretty typewriter screamed and the office boy rushed in with a fire extinguisher."

A second matter of current interest, also operating in Chicago, is the "Hall Process." This progeny of the well-known (and well-scored) "Proctor Process" of a couple of years ago, has been lately pushed into undue prominence by a clever use of printer's ink and the newspapers. Invitations to inspect the plant have been freely given and availed of, and, with others, I lately visited it.

Rumor hath it that this enterprise is shortly to be exploited in the domain of Mr. Pearson and (incidentally) Her Majesty Queen Victoria, in Toronto. In order to forearm our good friends over the "Line" and to allay the apprehensions of holders of Toronto securities, I shall risk trespassing in length to describe just what the "Hall Process," now operating in Chicago, consists of.

A Clybourn avenue cable car takes one to the city outskirts, in a region of soap factories and a maze of railroads. In an old boiler shop the plant is erected and weekly seances are given for the edification of the credulous investor and the hoodlums of the neighborhood. Dr. McAuliffe, President; F. G. Hall, Manager; and L. E. Dancey, Secretary, arrayed in shining shirt fronts, diamonds and silk hats, do the honors and "explain" (?) the system. The guileless gas man "laying low" does not need the explanation. The apparatus can be sized up in a glance or so. It consists of three vertical, firebrick cylindrical chambers, all enclosed in an elliptical wrought iron shell. The chambers are each some 4 feet in diameter by 10 feet high, located in order, one behind the other. The first is an ordinary generator, such as is used in any water gas apparatus. Soft coal half fills it, and about six 4-inch air blasts, fed from a high speed blower, are admitted at the base. With this amount of air, small wonder is it that there is "perfect combustion," and "nothing but ashes left," as is so glibly stated. This air is *blown through* the coal bed and emerges partly producer gas, *chiefly hot air*. Above the coal bed a stream of oil is forced in by a steam jet. This oil vaporizes, mingles with, and *carburets the hot air*, and there you have the "gas." The product is "greased (hot) air," and the *speed of the blower determines the amount of "gas" made*. The second and third chambers are maintained at a red heat by the continuous operation of the apparatus and the passage of the generator products through them, and they probably serve to very slightly further gasify the oil vapors. It is in these chambers that the celebrated "electrodes" are placed. Which aforesaid "electrodes," according to the promoters, "generate *electrical energy* by the passage of the gas over them, and decompose the steam (admitted with the oil) forming from it a perfect water gas, and all at a temperature of only 800°."

Shades of Moses, what a scheme! Have scores of gas men for years been ruthlessly, and needlessly, burning out their firebrick in attaining

twice and thrice that temperature for the decomposition of water? Why have we not hitherto all used "electrodes," that would do it at a gentle zephyr heat of but 800°? But the electrodes do something. One is warned to "look out for one's watch; electrical action may affect it!"

Such is the latest evolution of the electric gas process, a fit kinsman of "electric sugar." As a show plant it is fine—a vast volume of carbureted air burns noisily at the outlet of the machine, illuminating the neighborhood. As a commercial feasible process, Bah!

The thing is operated by "The Chicago Smokeless Fuel Gas Company." Offices have been taken in the big Auditorium Building and the dear public is invited to step up and purchase stock, State rights and wind.

The value of aforesaid stocks is illustrated by the following: One of the local meter men (not a *light weight*), recently took a party of eight or ten gas men out to see the "process," largely from a dearth of other evening occupation. In appreciation of said services a stock certificate for holdings in "The Chicago Smokeless Fuel Gas Company" in the thousands of dollars was sent him.

I opine that Toronto need not yet quake!

Business throughout the West is good. I could name a score of companies overhauling plants and increasing capacity. Gas sales are reported as well in excess of corresponding periods of last year. One company in particular reports over a hundred per cent. increase of output, and as a result of *pushing gas stoves*. This *is* an instance where one can say, "I told you so." Supply men and constructors report much business, and altogether Western gas interests seem to be keeping pace with the magnificent wheat crop of '91.

All eyes now turn towards New York for the October meeting. It is more than likely that Western men will center at Chicago, and a private car, or more, to New York and return "will do the rest." I think the car will have "push buttons," too.

Differential Rates.

[A paper read by Mr. T. Newbigging, C.E., before the Manchester District Institution of Gas Engineers.]

When all the circumstances bearing on the question are considered, it appears such a reasonable and fair thing to make a difference in the charge for gas inside and outside of the limits of a town, that the view that there should be such a difference needs only to be stated to receive general acceptance. Singularly enough, however, the question as to whether or not there ought to be a difference in price provokes much difference of opinion. Every now and again we read or hear of an agitation being promoted in such-and such a place for the abolition of the differential rate. Sometimes there is a shadow of justification for the claim of equal rates; but usually these agitations are not founded on reason.

Let us look into the subject. Take, for example, a town of considerable size. It covers an area which is thickly populated. There are streets in all directions, with dwelling houses shoulder to shoulder; shops and warehouses of every kind abound; workshops and manufactories are numerous. Open spaces, alas! are fewer than is desirable. Evidently, in such a place there is a heavy consumption of gas within a comparatively small area. This consumption is (say) at the rate of 5 million cubic feet per mile of main per annum. The gas works belong to the town; and, besides supplying the inhabitants thereof, the main pipes ramify out beyond the town limits into wide districts—it may be on one or two sides, or on every side of it. These outlying districts are largely residential. The houses, as a rule, stand apart; and there are often gardens to them, back and front. The population on an equal area is not one-half or one-quarter what it is in the town. There are not many shops, and but few warehouses; and there is an absence of manufactories. The consumption of gas per mile of main is light as compared with the other; amounting (say) to 2½ or 3 million cubic feet per annum. Here the unaccounted-for gas is necessarily higher; the capital expenditure is heavier in proportion to the consumption; and the expense of maintenance is more. It is clear, therefore, that the cost of distribution in the out-districts is greater, and the profit per 1,000 cubic feet considerably less, than it is within the borough. This is not an imaginary case that I am putting, but one founded on actual circumstances within my knowledge.

Again, the ratepayers in a town owning its gas works have to provide the capital for the hereditament as well as the working capital, and bear the risk contingent on the undertaking as a mercantile concern. Due cognizance must be taken of a fact of this kind. True, some of us believe that there is no real risk in the possession of a gas works managed with care and diligence. That, however, is a point upon which, whatever may be our opinion, we have no right to dogmatize in connection with the subject of differential rates. If there is a risk (and a prudent administrator will assume that there is), the ratepayers have to encounter it; and, at all events, it is a legitimate argument to use. I go further than that, and say that if justice is to be done as between the inside and the outside consumer, the possible risk must not be left out of consideration.

According to the latest parliamentary returns, I find that there are in the United Kingdom 59 statutory companies and 35 local authorities charging differential rates; the amount of the difference varying from 2d. to 2s. 6d. per 1,000 cubic feet. Of these, 20 have no maximum price fixed (14 of the number being companies under the sliding scale); 38 have only one maximum; and 36 a maximum within the town limits, and two or more for the outside districts.

It has been contended that where there is only one general authorized maximum, the charge for the gas should be uniform over the area of supply both inside and outside the town. How such an argument can be sustained I fail to see. It does not commend itself to my judgment as being at all conclusive; and if a case founded upon it should ever be stated for the consideration and decision of the Superior Courts, I have no doubt in my own mind that its falsity would be made manifest. The argument carries absurdity on the face of it. It is tantamount to saying that the owner of the undertaking should be compelled to supply gas at a loss.

In one or two recent instances the right to charge a differential rate has been withheld by Parliament—notably in the case of the Oldham Corporation and the outlying townships, which are supplied with gas by the Corporation. But there were special circumstances here that helped to justify that decision. The Corporation have one gas manufacturing station situated in one of the out-townships, and they were seeking powers to establish an important station in another of the out-townships. It could scarcely be hoped that, under the circumstances, they could reasonably continue to charge a higher rate for the gas that was produced in the center of the outside consumers' district, who had, moreover, to tolerate the existence of a gas works at their very door. Clearly this was a case where a "give and take" policy could be urged with some show of reason. But even in an extreme instance such as this there is room for question whether, after all, the decision of our legislators was according to strict justice: and certainly it can never be put forward as a precedent to be followed in places where the conditions are altogether different.

The circumstance that it is the juxtaposition of a sparsely populated district to a large and thickly populated town which enables the former to obtain its gas supply at a reasonable price, is often overlooked or wilfully ignored; and it would appear in some instances that nothing but the bitter experience of having to manufacture and sell their own gas at an enhanced price will teach ambitious out-districts the wisdom-lesson that some of them sorely need. I am no advocate for the harvesting, by local authorities, of exorbitant gas profits to go in reduction of the rates. So far from that, I have, in season and out, declaimed against the practice, which is as unfair as it is unsound and unwise. But it would be more grossly unfair to recognize the claim of the consumers of any out-district to have their legitimate gas charges reduced at the expense of the consumer within the limits of a densely populated town.

If, in places where a differential rate prevails, it can be shown that the price exacted, as compared with the price within the borough limits, is in excess of what reasonably ought to be charged, then undoubtedly the outside consumers have a legitimate grievance. In such a case a prudent gas committee would take steps to remove the ground of complaint, by adjusting the price to meet the circumstances. But, otherwise, they would be well advised in refusing to be influenced by unreasonable demands.

Freedom for Gas Works Construction.

The London *Journal*, in commenting on English laws relating to the construction of buildings, says that the interference of governing bodies with trading operations is a tendency of the times that grows more conspicuous every year, and continually takes fresh shapes, as the sense of responsibility for the welfare of the community deepens and widens in the minds of the public-spirited individuals who devote themselves to the duty of local administration. The duties ascribed to municipal corporations a generation ago were different in nature and scope from those laid upon the same bodies to-day, in a degree which can only be realized with difficulty by people now living, even if their memories

reach backwards to a respectable antiquity, and cannot be understood at all by such as have been born into the existing state of opinion in this respect. Whether we regard this development of the idea of local self-government as mischievous or salutary, the fact remains, and it is at least necessary to follow its course; for if it is a legal maxim that ignorance of the law is no excuse for the lawbreaker, it is obviously a canon of common sense that every man should do his best to "comprehend his epock." And there are few who more urgently need to keep abreast of the times than those who are interested in the great industry of gas supply, which touches the wants of the community at so many points, and is affected in so many ways by modern expansions of the idea of local self-government. We have lately seen how the gas industry, in respect of one of its branches—the manufacture of the sulphate of ammonia—has been brought into contact with the Excise laws in a way that would have been deemed fantastical a few years back. It is also in close contact in many respects with the sanitary laws; and the building regulations of many municipalities bear upon gas works in very intimate fashion. For this reason, it is desirable to take special notice of the progress of these regulations in leading towns, in order that it may be seen how they are gradually being altered and expanded from simple sanitary precautions and rules for securing public safety, into very elaborate and far-reaching enactments for placing the district surveyor—a local government official—in the place formerly occupied by the independent engineer and architect. And the point to be borne in mind in connection with this progressive magnification of the office of district surveyor is, that every legal extension of the powers of officials whose emoluments are derived from the public in the shape of fees, is apt to form the basis of new claims on the part of these ingenious gentlemen, whose perceptions, sharpened by self-interest, rarely fall short of the scheme of the legislation under which their powers are derived. The mere issue of a new set of building regulations for a certain town is usually the signal for a forward movement by the surveyors, who assiduously set the Courts of First Instance to which they have access, to work upon "test cases," until the probability is that, after a few years, the bearings of the law are found to be much more extensive than the framers ever conceived. It is not many years ago, for example, that the South Metropolitan Gas Company were hauled before the Magistrate sitting at Greenwich and made to defend the plans of their new East Greenwich works, because these comprised retorts houses of greater cubic capacity than the district surveyor thought warranted by the terms of the Act. This is a kind of visitation that may be inflicted upon any and every gas company carrying on operations in a neighborhood where the powers of a Building Act are adminstered by an enterprising surveyor. Most gas companies are so situated; for building regulations of some kind are in vogue all over the country, and it is not usual for gas companies to secure legislative exemption from their scope, as is generally done by railway companies.

It is indisputable that building laws and regulations have been productive of great good in many places where they have been intelligently administered; and it is also obvious enough, to all who have observed the proceedings of the "jerry" builder, that this class of regulations might be rendered more stringent and comprehensive, with advantage to the householding community. This view has struck the Building Act Committee of the London County Council, who have accordingly framed a new set of bye-laws referring to buildings, etc., under their General Powers Act of last year; and this code actually awaits confirmation by the Home Office, when it will become operative over the Metropolitan area. Both on account of its immediate importance, and also because it is a very good indication of the tendency of municipal opinion in this regard, the new code merits attention. Although the regulations will, in the first place, apply to the County of London only, they will almost certainly travel beyond that area; and this is the more to be expected, inasmuch as they have been considered and amended by the Royal Institute of British Architects, the Surveyors' Institution, the District Surveyor's Association and others interested in the subject. The code has thus been made a model one, and deserves to be taken as expressing the results of the most experienced observation in the working of building regulations in every thickly-populated region of the United Kingdom.

We do not propose to reprint the bye-laws a (copy of which may be obtained from the printers to the County Council), but only to draw attention to such of the provisions as may be considered of special importance to our readers. It is necessary to state, however, to begin with, that the code does not touch main or service laying, internal gas or water fitting, or plumbing work of any description. This is probably to be dealt with in a separate ordinance, to which we shall pay due attention when it appears. The regulations now under notice apply wholly to the sites and foundations of buildings, materials of construction, plastering, etc.; and therefore they interest the architect and builder more immediately than they do the gas engineer. Seeing, however, that these rules are to govern the erection of every house or building, whether intended for residence, factory use, or otherwise, and that not even a gasholder tank is excepted from their operation, it is desirable that their meaning should be clearly understood.

The most sailent feature of these bye-laws is the way in which they disestablish the independent engineer, and set up the district surveyor in his stead, in respect of everything that stands for responsibility for good construction. The architect or the engineer is permitted to design the structure to which these regulations apply; but here, to all intents and purposes, his responsibility ends. All those provisions of building specifications which deal with the qualities of materials are supplanted by this set of by-laws, which not only tell the designer of what materials his construction must be built, but fix the proportions of materials to be employed in the preparation of his concrete, mortar, and plaster. Take such a rule as the following: "The cement to be used must be Portland cement, or other cement of equal quality, to be approved by the district surveyor, mixed with clean sharp sand or grit, in the proportions of one of cement to four of sand or grit." Again, with reference to concrete, it is proposed that "whenever concrete is used in the construction of walls, the concrete shall be composed of Portland cement and of clean Thames or pit ballast, or gravel, or broken brick or stone, or furnace clinkers, with clean sand in the following proportions—viz., one part of Portland cement, two parts of clean sand and three parts of the coarse material, which is to be broken up sufficiently small to pass through a 2-inch ring." The importance of this by-law will be seen when it is remembered that, if it had been in force last year, the new concrete tank at East Greenwich, described in the *Journal* for April 14, last, (p. 687) could not have been carried out in the manner actually adopted. Moreover, the operation of the new code will affect gas companies in other ways than by telling them how their tanks and retort houses are to be constructed. During the last few years there has been a marked development of breeze-concrete construction for ceilings, &c., of fire proof buildings. It is recognized by architects that concrete made with coke breeze is the lightest that can be prepared with materials generally available; and it is largely used for buildings under the County Council itself. Yet it is conceivable that any district surveyor might set his face against this material, and contest its claim to be admitted as "grit" under the terms of the regulation.

In so far as the new by-laws are intended to apply to ordinary town dwelling house building, there is perhaps little to find fault with them, beyond the general objection to putting the district surveyor in the place of the responsible architect or engineer, provided that it might be assumed that the official in question would always act with intelligence, and be able to ensure that the rules and his own directions under them should be complied with. The best that can be said for the code is that in the many instances where building is carried on without any proper professional supervision, it holds out the hope that the district surveyor will come in to check the worst abuses that have grown up under such conditions. In such cases, however, it is at least doubtful whether the interest attendant unon his claim to his fees will be sufficient to keep the official of the County Council on the alert against the manifold artifices of the speculative builder.

The worst that can be alleged against the new by-laws is that they are too rigid in regard to constructions where competent engineering skill is engaged upon work, the nature and requirements of which are such as to place it outside the range of the ordinary district surveyor's experience. It does not follow, for instance, that what is good for a 9-inch party wall between terrace houses must also be necessary for a gas holder tank wall 4 feet thick; or that cement concrete and rendering must be gauged in the same proportions for all purposes. Good concrete and plastering are not to be ensured by merely stating proportions. It is quite possible for a 4 to 1 wall to be bad, and for a 16 or even a 20 to 1 wall to be sound. Quality, workmanship, supervision, bulk, position, purpose, all operate to affect the ultimate result. It amounts to this—that if local authorities are going to prescribe the method of construction of all buildings within their limits, inclusive of those in gas works, it will be necessary for gas companies to protect themselves from interference, precisely as the railway companies have done. It is not enough that building by-laws may be suspended by leave of the authorities in certain cases. This permissive exemption, being against the interest of the surveyors, will always be opposed by them, and they will seldom fail of having the ear of the authority for whom they act. It is not merely a question of fees, although this is not a matter of insignificance, seeing that not one brick can be put upon another, within a district surveyor's jurisdiction, without payment of his dues; but it is more a question of liberty in construction for technical purposes, which must certainly not be yielded lightly.

Oil Tank Steamers.

[A paper read by Mr. George Eldridge at the annual meeting of the Institution of Naval Architects.]

The great importance to the mercantile marine, and, it may be said, the country in general, of the importation of oil to European ports from the American and Caspian oil springs, was not fully realized until attention was drawn to it in the paper read by Mr. Martell before the members of this Institution at their meeting at Liverpool in the year 1886.

Up to that time nearly all the oil which had been imported to Europe from America had been carried in casks and tins, and the expense attending this mode of its conveyance had restricted within very moderate limits the quantity imported. When, however, the great saving of cost was shown in the conveyance of oil in bulk, as compared with its carriage in casks and tins, a great impetus was given to this trade; and whilst at the date referred to only about 12 vessels were employed in this trade, at the present time between 70 and 80 vessels, carrying from 2,000 to 4,000 tons of oil each, are exclusively employed in carrying oil in bulk from America and Baku to various European ports. Many alterations have been made since the above date to the present time in types and sizes of vessels employed in this trade, and sufficient time has now elapsed, and experience been gained, to enable a review to be taken of the manner in which the vessels engaged have performed their work, and also as to the best design suited for the purpose. This is the object of the paper which I have now the honor to read with considerable deference to the members of this Institution.

I am emboldened to undertake this from the fact of my association with the first bulk-carrying oil steamers which were constructed for the Atlantic trade.

In 1872 a contract was made by Messrs, Palmer & Co., of which firm I was then manager, with a Philadelphia firm, for building three steamers of 2,748 tons gross register each, for carrying oil in bulk from New York to Europe. Although circumstances arose which diverted the employment of these vessels, they were completed and made fit in every respect to engage in this trade, had the owners so determined. A description of the construction of these vessels is embodied in the Transactions of this Institution, and I only allude to them to give expression to the interest which from that time I have taken in the subject of carrying with safety oil in bulk on over-sea voyages.

This interest has been still further increased by the fact of my engagement by the Anglo-American Oil Company, London, and the Standard Oil Company, of New York, to advise them in arranging designs and specifications for their first Atlantic oil-carrying steamers to convey oil in bulk, since which time I have been employed in surveying more than one-third of the whole bulk-carrying oil steamers afloat, which I may remark have been purchased by the companies above referred to. It is needless to say that this experience has brought under my notice many weak points in the construction of this description of vessel, which have led to serious inconvenience and expense both to the shipowners and the underwriters, whilst the best type of vessel for prosecuting this trade has been suggested.

In dealing with the points of faulty construction, or inefficient arrangements which have come under my observation, I would first draw attention to the fitting of the deep keel-plate connected to the flat keel-plate, which system of construction is very generally adopted for this description of vessel. This deep plate, instead of being continuous throughout the length of the vessel, is often abutted against the transverse bulkheads, and connected to the same by a single angle bar only, the latter of which I have found insufficient in size and the rivets too small for the strains brought upon them. The result is that the flat keel-plate butts, together with the brackets connecting the longitudinal plates and angle bars to which the same are connected, are found to be strained, the butts wasted, and the rivets loose and leaking. This working of these parts is transmitted to the adjacent parts, and in some instances has been found to extend to a considerable distance. Instead of breaking up the longitudinal vertical plate, it should, in my opinion, be made continuous, thus avoiding depending upon rivets alone, and should either be lap-butted or have double butt straps fitted, and in either case be treble rivetted. In some instances where this system of construction has been adopted, no working has been found to take place from excessive strains brought on the rigid points where the transverse bulkheads are fitted, and much subsequent repair and additional strengthening have been avoided.

When these vessels leave a home port in ballast it is customary to fill a portion only of the oil compartments with water. In an Atlantic voyage performed under these conditions, when the vessel is encountering heavy seas, exceptional longitudinal strains are brought on the bottom, thereby rendering it of the greatest importance that, where the continuity of strength is obtained by the method referred to, the utmost care should be taken to have, in addition to sound workmanship, the brackets sufficiently large, and the number and size of rivets well regulated.

Exgerience has shown that of the various methods of connecting the butts of the outside plating, none is so effective for insuring oil tightness as the system of lap-butting throughout. Many instances have occurred where the outside strakes have been lap-butted, and the butts of the inside strakes connected by the ordinary single butt strap; the latter have proved insufficient for the purpose, which has resulted in the necessity of fitting double butt straps, the expense of which would have been avoided had lap-butting been originally adopted throughout.

The fitting of independent tie beams in oil compartments has also led to very unsatisfactory results. The local straining brought on the ends of such beams almost invariably leads to undue stress on the rivets of the beam ends and edge plating in the locality. Local ties of this kind, unless longitudinal brackets are fitted to their ends to disperse the stress brought at this part, are sure to cause a tugging on the rivets and leakage. To provide for transverse strength within each compartment, no better method has been found than to fit substantial web frames from six to eight frame spaces apart; where this has been done the structure has remained perfectly rigid.

Transverse bulkheads forming the oil compartments have, in many instances, been constructed much too light, and have subsequently had to be considerably strengthened. Where leakage takes place, or there is considerable rising and falling of the oil or water in the compartments, undue strains are brought on these bulkheads, which result in ganting, and the heads and points of the rivets breaking off. Many of the defects found in bulkhead rivets are also due to the slight countersinking, or absence of it altogether, either in the plating or in the stiffening bars. It is not too much to say that in some instances where considerable working has taken place, involving great expense for repairs, the initial cause has been from this negligence, thus showing the primary importance in oil-carrying vessels of sound and careful workmanship. The best method of construction of the transverse bulkheads is to fit the plates vertically with an additional plate above the deep floor plate, with lapped edges and butts having a double row of rivets arranged zigzag, the edges so arranged as to be clear of the vertical stiffening bars, that they may be efficiently caulked. The heads and heels of the stiffening bars and web frames should be secured by substantial knee brackets, kept clear of the caulking edge of the bar. The transverse stiffeners or girders should be extended in one length from side to side of the vessel, and not butted against the vertical middle line bulkhead, as is frequently done; these should be connected to side stringers with bracket knees not less than 4 ft. long, with treble-rivetted joints, and the face angle bars on the girders should be continued around the bracket knee. The absence of continuity of strength such as this has led to unsatisfactory results.

In many cases the longitudinal middle line bulkhead has been fitted of very slight scantlings—in fact, the bulkhead has been regarded as a screen only—and the result has been that they have had to be considerably strengthened. This bulkhead should be of a substantial character, and made practically oil-tight. Its purpose, though not for longitudinal strength, is most necessary in preventing the oil or water from moving from side to side of the vessel when filling or emptying the compartments. It has been the practice with some builders to form holes in this bulkhead, and also in the vertical keel-plate, so that the oil may have freedom to move from side to side. This, in my opinion, is most objectionable, and destroys the purpose for which the bulkhead is fitted, viz., to prevent the vessel from taking a heavy list on one side or the other, which has sometimes been the case to a dangerous extent.

The only reason I have heard given for perforating this bulkhead is to make provision for the possibility of a suction pipe in any double oil compartment becoming choked or disabled. Should such a case occur, the oil or water ballast could be pumped out by the adjoining suction pipe, and the risk would be infinitely less than having movable liquid not under control, which at any time embodies a serious element of danger.

Should it be considered necessary, provision could be made for a suction pipe possibly becoming disabled by fitting a plain sluice valve, with rod attached for regulating the same, continued to the upper deck in each oil compartment, and thereby having control over the liquid in the event of a great inclination of the vessel, or a defective suction pipe, taking place.

I may state that the experience of many captains of oil vessels whom I have consulted confirms this conclusion, and in several vessels where such openings have been made they have subsequently had them covered over.

The deck beams in most oil vessels are of angle bars, and in some cases to these are fitted short knee-bracket plates connecting them to the vessel's sides. Othor vessels, again, have plain welded knees, which in several cases I have found to be broken through the welds, and, where not broken, the rivets have in many beams in both plans worked loose. This has been owing to the inefficient and slight scantlings of the plates, and reduced thickness in many cases where welding has been adopted, whilst the rivets have been deficient in diameter. In oil vessels carrying from 3,000 to 4,000 tons of oil, the rivets in my opinion should not be less than $\frac{7}{8}$ in. in diameter, with six rivets in each beam arm. In vessels of this size bulb angles or bulb T form should be adopted, notwithstanding an iron or steel deck is fitted, and the same should have either the ends turned down or substantial knee plates fitted sufficiently long to take the above number and size of rivets.

Except at the ends of the vessel, where the oil compartments finish, I do not consider it necessary to have the intermediate transverse bulkheads fitted between double frames. This causes a double row of rivets, very close to each other, extending around the whole girth of the vessel, and increases greatly the risk of leakage, whilst in such vessels a single row of rivets connecting these bulkheads to the vessel's sides has been found sufficient.

The arrangement of expansion trunks is of considerable importance, and several systems of carrying this out have been adopted :

1. In spar-decked vessels an advantage has been gained by fitting this trunk continuously throughout the length of the oil compartments, increasing the strength of the vessel longitudinally. On the other hand, this plan causes contracted, dark spaces on each side of the long trunk, which are difficult to ventilate unless with a number of cowls, which are liable to be carried away in boisterous weather such as is met with in the Atlantic. These spare spaces are frequently used for the stowage of reserve bunker coals, but the labor and inconvenience of conveying them to the stockhold in the after part of the vessel, does not commend the arrangement to those who have to navigate the vessel.

2. Another arrangement is to fit separate trunks to suit double compartments. This system possesses the advantage of giving a considerable amount of support to the structure above the main deck or tank top, whilst affording better light and ventilation between decks. It also enables the spare bunker coals to be nearer the stokehold, thereby economizing labor and time, and expense in trimming.

3. The plan adopted in some oil vessels of fitting expansion trunks on each side of the middle line is open to much objection. It involves considerable danger owing to the difficulty, with small openings, in making a thorough examination of the oil compartments before loading and after the cargo is discharged. This cannot be too carefully attended to, and difficulties arise in doing it effectually where small entrances only exist, which necessarily tend to inefficient lighting and ventilation.

Many differences of opinion have existed respecting the best form of rivet to use for connecting the various parts in oil vessels to insure oil-tightness. By some eminent builders of this class of vessel, it has been held that no form of rivet was equal to the plug-headed rivet for this purpose, whilst others as strongly held that the pan-headed rivet had been found under all circumstances to be the most efficient for any purpose for which a vessel might be required. Some years ago a series of experiments was made in one of Her Majesty's dockyards for the purpose of ascertaining the relative merits of various descriptions of rivets. Of three kinds which underwent crucial tests, viz., the plug-headed, parallel, pan-headed, and pan-headed with swollen necks under the head, the latter description of rivet was found best for all purposes of ship construction. Experience with oil vessels has likewise shown that the swollen neck pan-headed rivet is not only superior to all others for insuring strength, but also for oil-tightness. Dispensing with the pan-head certainly reduces the weight of the rivet and consequent cost, but in the number of vessels which I have surveyed where the various kinds have been used, I have found that the results of the Admiralty experiments still hold good, and that the least number of defective rivets were those of the latter description.

The arrangement of pumps on board oil steamers is deserving of attention. The pumps should be placed as conveniently near to the boilers as possible, with a view to minimising the condensation of steam in the pipes, which, during frosty weather especially, is a source of trouble and loss of efficiency. Several ways have been adopted of leading the suction pipes from the pumps to the oil compartments. In some instances they have been laid on the top of the floors at the bottom of the vessel, and connected to the transverse bulkheads with expansion joints in the middle of the compartments. In other cases they have been continued along the main deck on the tank top, with a branch suction led down into each compartment, with valve-rods worked from the deck above. Others have been fitted inside the expansion trunks, with valve-rods for opening or shutting led to the deck above.

My experience has been that the most satisfactory plan is to lay the pipes on the top of the floors with a branch suction to each compartment, and controlled by a valve with rods worked from the upper deck. This, in my opinion, will be found the least liable to defects. The efficiency of the pumps is sometimes found to be much impeded owing to the oil not finding its way readily from one frame space to the other. The limber holes should not be less in area than that of the suction pipe; instead of which these holes are sometimes formed by cutting a small triangular piece off the bottom of the floors where they are connected to the middle line deep keel-plate. Where the oil has not ready access to the pumps, much delay is caused in draining the bottom of the tanks whilst racing, and consequent injury is caused to the pumps.

Another important point in connection with pipe arrangement is to avoid carrying the oil pipes into any other compartment than those specially intended for carrying oil. It has often been the practice to employ the oil pumps for filling and emptying the foremost deep water ballast tank and fore peak tank by adapting the oil pipe line to these compartments ; the consequence is that in carrying this out the water passes through pumps and pipes conveying a certain amount of oil with it, and the result is the accumulation of an amount of gas in the tanks without any means for its escape. This is a source of danger which it is well to avoid. The oil pumps should only be used in connection with filling or discharging oil, whilst a separate donkey pump should be fitted forward with suction and filling pipes for the deep water ballast tank and fore peak, and it might at the same time be adapted as a fire pump, and would thus be invaluable in the event of fire occurring.

I may remark that vessels engaged in the oil-carrying trade are not subject to corrosion to the same extent as vessels engaged in general trade, as it is found that oil has a general preservative effect. At the same time, careful attention should be given to parts such as the main deck, where reserve bunker coals are stowed. In several vessels I found considerable deterioration had taken place at this part, extending throughout a length of 50 ft., occasioned apparently by an accumulation of water mixed with small coal, and possibly setting up a chemical action. I mention this because, in steel vessels, the attention I recommend becomes the more necessary.

Opinions have recently been expressed by builders and others as to the original intention of designers and owners in fitting double bulkheads on the fore side of the machinery space in the after part of oil-carrying vessels. These spaces were undoubtedly described in the early construction of these vessels as water spaces, and the intention was that, when the vessel was filled with oil, these spaces, for greater safety, should be filled with water. Cases have occurred where these spaces have been neglected to be filled, and leakage has taken place ; oil has found its way amongst the bunker coals, thereby occasioning considerable danger. Had this space been filled with water, this could not have occurred, as the oil would have floated on the surface of the water, and could easily have been removed. The space is sometimes made only one frame space, or about 2 ft., between the bulkheads, and badly ventilated; and I have known a sea cock and oil suction pipe fitted in this space. It is evidently very difficult for a man to find his way into this space to effect repairs or cleaning, and doubtless this is why it is found to be the most dirty and neglected part in oil vessels. This space should not be less than two frame spaces, or about 4 ft. fore and aft, and should be kept clean and frequently visited. I am strongly of opinion that owners of these vessels should issue distinct instructions, as many do, that when the vessel is oil-laden, this water space should be filled with water as originally intended.

The question of clearing the oil compartments of gas when men have to enter them for examination or repairs, is one the importance of which has more than once been painfully brought under our notice. It has been the practice with some owners to fill the tanks to overflowing, skimming off the oil as it rises to the surface, and then pumping out the water. Although this is doubtless the most effectual means of freeing the compartments of oil and gas, still experience has shown that we cannot remain satisfied with this should it be necessary to enter the tanks some time after this has been done. There are so many interstices in the inside of a vessel where merely filling the hold with water will not eliminate all the oil that constant precaution is necessary after this has to be done, as evaporation from heat of the small remaining portions goes on, and explosive gas is produced. It is, under these circumstances, of considerable importance, in my opinion, to have a number of rivets driven out of the bottom for the escape of the gas ; and still further to assist this, to have windsails in every compartment. Recent experience appears to show the necessity of going beyond this, and, in-

stead of disturbing the rivets, of forming about three plugholes in each oil compartment, about 1½ in. in diameter, which, with windsails and the hatches kept open, would, in my opinion, effectually keep the holds free from gas. No practical difficulty would occur in being able to effectually close these holes with plugs, so that they could be removed as necessity arose; and, it is thought, much of the danger which now exists in visiting the holds of these vessels would be obviated.

Many alterations in the designs of vessels constructed to carry oil in bulk have taken place since the first steamer intended for this purpose was built in England in the year 1872.

This vessel, which was of 2,748 tons, was constructed with two skins about 26 in. apart, and the main hold to the height of the lower deck was divided into ten separate compartments. A great rise of floor of about 3 ft. 6 in. was adopted with a view to raising the centre of gravity of the oil and cargo, and thereby reducing the initial stability. Experience has shown that by adopting the principle of having empty spaces between the outside skin of the vessel and the oil tanks, much danger is incurred from the facility thus afforded for gas accumulation, and in more recent designs this system has been abandoned.

In conclusion, it may be remarked that, notwithstanding the dissatisfaction which has been expressed by many interested respecting the performances of some steamers which have been engaged in carrying oil in bulk, the causes which have given rise to this dissatisfaction are not far to seek. When the great impetus was given five or six years ago to building vessels for carrying oil on over-sea voyages in bulk, but little was known of the risks to damage which such vessels incurred. The permeating qualities of petroleum were known, and the knowledge that a large number of small vessels had been successfully engaged for some years in carrying oil in bulk on the inland seas and rivers in Russia; but this gave very little indication of the requirements of strength and local arrangements for vessels engaged in such trade crossing the Atlantic in the winter seasons. Consequently it was felt that if vessels were built of equivalent strength to those which had been doing their work satisfactorily when carrying cargoes of varying densities, and in many instances indifferently stowed, the fact of the transverse strength, as in oil vessels, being greatly increased by a large number of bulkheads, and the cargo being of a homogeneous nature, should add still further to their safety. Something more than this, however, was necessary to enable these vessels to cross the Atlantic satisfactorily when fully laden with oil. In the first place, although the additional number of bulkheads increased their transverse strength, yet the necessity of making them water-tight broke up the continuity of strength attained by the stringers, keelsons, etc., extending, as in ordinary vessels, all fore and aft. These longitudinal connections had to be discontinued at the bulkheads, and attached to the same by brackets. The inefficient manner in which this was done in many instances—the brackets being deficient in size, and the rivets too small and few in number—doubtless led to inefficiency in some of these vessels when encountering heavy gales. Added to this was the want of experience of many of the captains. In some instances it was known that when the vessels were thought to be unduly light and too tender, one or more of the compartments were run up in mid-ocean, and the effect of this large volume of moving water in straining the vessel can be easily imagined. Again, some of them were too deeply laden when crossing the Atlantic in mid-winter, and undue straining resulted from this cause.

I am of opinion that no amount of additional scantlings beyond what has been pointed out by me would cause more satisfactory results. It is more a question of local connections and sound workmanship. In fact, the riveting should be arranged as for boiler work, and equally well done.

History of the Bradford Oil Field.

The Bradford *Era* recently printed the following valuable synopsis of the oil yield in the Bradford (Pa.) district, the history of which is a record of the wonderful development of a wonderful American industry. Our authority says that the Bradford field was at the height of its career in July and August, 1881, when the flood of crude was so great that it became an utter impossibility for the pipe lines to take care of it all. Large quantities ran to waste and conservative judges estimate that the production for several days at a time attained above 100,000 barrels. The average runs for August, 1881, were 80,838 barrels a day, and the average daily runs for the entire year were 70,811 barrels. Stocks accumulated and the supply of petroleum rapidly exceeded the demand. But this enormous yield could not be maintained, notwithstanding new territory was constantly being added to the borders of the field and new wells continued to be drilled in every direction. The production gradually descended the scale, with now and then an occasional gain, but the decline has been more or less constant from an average of 80,000 down to 50,000, and then to 40,000 and 30,000 barrels a day, until January, 1888, when the pipe line figures show but 11,329 barrels a day. These last were during the lowest ebb of the shut down period. There was a rally from these figures and in December of the same year the runs reached 17,350 barrels a day. Again, in April, 1890, a rise is seen to 17,856 barrels, but since then a decline has steadily continued until July, 1891, when the daily average is but 14,617 barrels. The average daily pipe line runs of the Bradford field by years have been as follows:

	Barrels.
1878	16,980
1879	38,584
1880	55,173
1881	70,811
1882	51,030
1883	36,812
1884	33,052
1885	29,228
1886	26,980
1887	20,722
1888	13,992
1889	16,462
1890	16,713

Daily Average Pipe Line Runs—Bradford Field.

	1882.	1883.	1884.
January	55,006	36,487	31,020
February	63,313	38,481	33,987
March	58,078	37,754	33,049
April	53,008	38,810	34,370
May	55,955	39,039	34,946
June	56,016	38,614	35,701
July	52,456	36,489	34,718
August	49,711	37,165	33,782
September	46,585	35,894	33,449
October	42,107	35,654	31,500
November	41,404	34,516	29,552
December	39,580	32,650	30,632
	1885.	1886.	1887.
January	27,254	27,966	23,133
February	27,480	27,499	22,680
March	26,833	29,333	22,677
April	29,557	28,640	22,791
May	28,443	27,552	22,540
June	30,662	28,790	22,892
July	30,657	27,587	21,051
August	29,291	26,785	21,818
September	30,151	26,394	21,203
October	30,828	24,596	22,911
November	29,117	24,690	11,724
December	30,376	24,002	13,292
	1888.	1889.	1890.
January	11,329	16,228	17,279
February	13,854	14,701	17,293
March	13,378	16,755	16,796
April	14,057	16,253	17,856
May	14,590	15,815	17,476
June	14,298	16,956	17,201
July	13,641	17,131	17,200
August	14,198	16,759	16,138
September	12,214	16,500	16,414
October	12,529	16,774	15,908
November	16,489	16,646	15,542
December	17,350	16,875	15,509

The daily average pipe line runs for the past nine years are shown in the above table. The shut down movement commenced in November, 1887. In the month previous the runs were 22,911 barrels. The closing in of the production brought about a decline of nearly one-half in 30 days' time. Since that time the Bradford runs have never touched the 20,000-barrel point.

In the following table a comparison of the runs is made for the first seven months of 1889, 1890 and 1891:

	1889. Barrels.	1890. Barrels.	1891. Barrels.
January	16,228	17,279	16,002
February	14,701	17,293	14,897
March	16,755	16,796	15,596

	1889. Barrels.	1890. Barrels.	1891. Barrels.
April	16,253	17,056	15,884
May	15,815	17,476	14,667
June	16,956	17,201	15,617
July	17,131	17,200	14,617

It will be seen that the runs for July are very closely approaching the figures that prevailed in 1888, the shut down year.

Making due allowance for waste oil lost, burned, etc., and taking the pipe line runs as a basis the total production of the Bradford field down to December 31, 1890, has been as follows:

	Barrels.
1868 to 1875, inclusive	36,000
1876	380,000
1877	1,450,000
1878	6,500,000
1879	14,200,000
1880	22,300,000
1881	23,000,000
1882	18,000,000
1883	13,400,000
1884	12,200,000
1885	11,000,000
1886	10,000,000
1887	7,700,000
1888	5,400,000
1889	6,200,000
1890	6,400,000
Total	158,166,000

For the first seven months of the present year, the production figures about 3,250,000, which will bring the total production of the Bradford field up to 161,400,000 barrels. It would require over 4,600 iron tanks of 35,000 barrels capacity to contain this quantity of oil.

The Pressure of Gas in Coal.

Coal in the bituminous mine seams is always more or less subjected to bleeding. This is well known to the practical miner; he is constantly observing the sweating of the coal, accompanied with a hissing sound. The sweating undoubtedly is produced by the pressure of the gas stored up in miniature cavities and fissures of the seam.

The pressure of the gas is a subject of increasing interest; it has been found in some cases to be nearly equal to the pressure of the steam in the boilers of steamships. Pressures of 200 lbs. and upwards have been found to be common in deep seams newly opened out. What is interesting about the matter is the co-relationship of the pressure of the gas to the pressure due to a vertical column of water, measured from the seam to the drainage level of the rocks overlying the seam.

To make this clear, let us suppose a seam to be 250 fathoms from the surface; again, let us suppose that the drainage level is about 50 fathoms from the surface. Now by this data we may with considerable accuracy calculate the pressure of the gas stored up in the cavities of the seam.

Suppose the seam has not been wrought, but has been pierced by a bore hole; if a long iron tube was inserted in this bore hole and made gas tight, that is to say, made to fit the hole so closely by some system of packing that no gas could escape, and a pressure gauge was screwed on the upper end of this pipe and allowed sufficient time for gas to accumulate in the bore hole, the pressure ultimately observed might first be calculated as follows: vertical height of water being 200 fathoms, then—

$$\frac{200 \times 6 \times 62.5}{144} = 520 \text{ lbs. pressure on the square inch.}$$

This calculation might, however, have been made by a simpler process, which we highly recommend; a square inch column of water having a vertical length or rise of 6 ft., weighs nearly 2.6 lbs., therefore $200 \times 2.6 = 520$, or is equal to a pressure of 520 lbs. on the square inch, as before.

Often, as faults and dislocations, water and gas are met with in unusual quantities; sometimes on cutting a fault, gas is given off generally at the bottom of the seam, and this gas often consists of sulphureted hydrogen. Water is often met with at faults, and it generally comes off at the fault at the top of the seam, and after the water has expended itself, it is followed by gas, which also consists of sulphureted hydrogen. Now, why gas should be found at the bottom of the seam and water at the top of the seam is a matter full of interest. Water is sometimes given off at the bottom of the seam, and when that is the case the reason why requires observation and investigation.

Now when water is given off at the bottom of the seam, some cavity in the neighborhood of the fault contains gas at a high pressure, but is situated above another cavity filled with water, so that while gas is pressing on the water, water flows from the bottom of the seam, through some vent or parting in the fault; but as water is heavier than gas, if the water and the gas are found in one cavity in the bottom stratum of rock communicating with the fault or fissure, then gas only is given off, and sometimes at a high pressure. But it will be noticed that after a while the gas is all spent off, and the air in the neighborhood of the fault resumes its normal condition. The gas is expelled by the operation of Boyle's law; it exists in this bottom cavity at a pressure considerably above that of the atmosphere, and if the pressure of the gas in the cavity was three times that of the atmosphere, on that pressure being removed it would expand into three times its original volume, or every cubic foot in the cavity would expand into three cubic feet, two of which would be expelled.

When the water is given off at a fault at the top of the seam, we may certainly expect this water to be followed by gas, because, being lighter than water, it is pent up at a high pressure above it, and the high pressure of the gas causes a rapid or violent outflow of water. Now as the gas cannot sink in the water, being lighter, if the bottom of the cavity communicates with the fault, then no gas will spend off until the water has all been expelled.

These facts correspond with every-day experience, and happy is the man that takes a pleasurable interest in these matters, because it is out of such observations that knowledge and experience are matured, and men are made useful and profitable to themselves and others.

Spontaneous Ignition of Coal.

Prof. Vivian B. Lewes, in a paper on the "Spontaneous Ignition of Coal," presented to the British Association, observed that ever since Berzelius first suggested that the heat evolved by the oxidation of the pyrites in coal might have an important bearing on spontaneous ignition, it had been adopted as the popular explanation of the phenomenon, and although the researches of Richets and others had gone far to disprove it, this theory was the generally accepted one. It could be proved, however, that the coals most liable to spontaneous ignition often contained as little as 0.8 per cent. of pyrites, and rarely more than 2 per cent.; and if this amount were concentrated in one spot instead of being spread over a very large mass, and if it were oxidized with the greatest rapidity instead of taking months and often years to complete the action, the total rise of temperature would be quite inadequate to account for the ignition of the coal, which required a temperature of 370° C. to 477° C., according to its characteristics. The liability to spontaneous ignition also did not increase with the percentage of pyrites, while heaps of pure pyrites, free from carbonaceous matter, never showed any tendency to serious heating.

The true explanation of ignition of coal was partly physical and partly chemical. Freshly won coal had the power of absorbing from 1.5 to 3 times its volume of oxygen from the air, and this being rendered chemically highly active, partly by compression and partly by elimination of nitrogen, attacked some of the bituminous hydrocarbons in the coal, converting them into carbon dioxide and water vapor. Many causes tended to effect the rapidity of that action, which was the real source of the heat, and directly the temperature began to rise, unless the heat evolved could freely diffuse itself, the chemical action was so energetic that ignition quickly followed. Up to 38° C. the absorption of oxygen and consequent chemical action went on so slowly that there was little or no chance of undue heating; but directly that temperature was exceeded with some classes of coal, ignition was only a question of time and mass. The action of mass, condition and temperature could be beautifully traced in the statistics of spontaneous ignition of coal cargoes, while the bunker fires, which were now becoming perilously frequent on the fast liners, were due entirely to rise in temperature from the bunker bulkheads being too close to the hot-air upcast shafts from the boilers and furnaces.

Sometimes the heat to start the reaction was acquired in the tropics, and afterward went on increasing until fires somewhat frequently broke out off the Cape of Good Hope. In the large liners the boiler casting was only separated from the coal bunkers by 9-in bulkheads, and at the point of greatest heat the temperature was sometimes 200° C., but near the sides of the ship, where the heat could more freely escape, the temperature was sometimes about 73° C. The fires did not usually begin at either of these points, but at points where the temperature was intermediate, for there was a free supply of air, a thin line of charred coal extending thence to the place of highest initial temperature.

In the discussion which followed the reading of this paper, Sir Lowthian Bell said he had not found spontaneous fires in his works to begin at the surface of the coal, but lower down; Sir Frederick Bramwell thought that Mr. Lewes had proved his case, and hoped that he would suggest a remedy. On no occasion did he remember that combustion began at the top or anywhere near it. Radiation and other causes might make the fire rage most furiously below the point where ignition actually took place. Prof. P. P. Bedson said he had of late been experimenting with the gases given off from coal dust. He was of opinion that the cause of explosions in coal dust was not from pyrites so much as from hydrocarbon or some resinous bodies in the coal. He believed that explosions took place very frequently at ordinary temperature. Given sufficient mass and sufficient time, one could get an explosion of coaldust at 100° C. or below.

Professor Lewes, in reply, said with regard to ignition on board ship, he thought that if there were a circulation of cold sea water between the boiler space and the coal bulkheads the coal could never reach the temperature of ignition. This could be accomplished by the addition of another 9 inch bulkhead. It would make in effect a sort of "water jacket," and would be of great advantage on iron-clads, where the smokeless powders and other explosives were likely to be injured by the heat.

Mr. C. W. Young on Standard Sperm Candles.

Some months ago Mr. C. W. Young, F.I.C., F.C.S., read a paper before the Society of Chemical Industry on standard sperm candles, that attracted much attention among the fraternity on the other side of the Atlantic. At the request of several of our subscribers we reprint an abstract of Mr. Young's remarks, as the same appeared in the London *Journal* of Feb. 10, 1891.

Mr. Young commenced his paper by remarking that a common expression used in reference to sperm candles was: "I get very good results with them when they are properly used;" but it was difficult to get a clear definition of what was meant by "properly." For 23 years he had used candles daily, and had devoted much attention to them for the purpose of ascertaining the causes of their defects and the means of remedying them. From time to time since 1876 he had stated his opinions on the subject in the correspondence columns of the *Journal of Gas Lighting*, and in the number for April 2, 1889, would be found a letter in which he gave the following mode as the one in which candles should be used so as to give fairly uniform results: "No test should be taken with candles that had not previously been burnt until the tips of the wicks glowed, and then extinguished and allowed to cool two or three times." At the time this letter was written it appears that he had not made any systematic investigations on the subject; but he afterwards commenced a long series of experiments, which formed the substance of the present paper. He experienced great difficulty at the outset in devising some means by which a uniform volume of light could be produced at any moment for the purpose of testing the candles; but ultimately he succeeded very well by means of a simple apparatus, consisting of a screen of fine wire gauze fitted tightly to the rim of the gallery of a "London" Argand burner (such as is prescribed by the Gas Referees for testing common gas in the metropolis), and extending 3 or 4 inches below—the bottom being closed by resting on the photometer case. The currents of air supplying the burner were in this way equalized; and the result was that, with a good burner, the flame burnt with a perfectly even top, so that it could be measured, up to 2.8 inches, to within a tenth of an inch. This little apparatus, Mr. Young incidentally remarked, could be obtained of Messrs. W. Sugg & Co. He found that a 2½-inch flame was the most promising for his purpose; and a modified Evans photometer, in which the disc was stationary, was employed—strict cleanliness with regard to the candles being observed. With the view of ascertaining the value in candles of the 2½-inch flame, he tested it against candles selected as fulfilling as nearly as possible his requirements of what candles should be, so as to give an amount of light proportionate to the sperm consumed; but they were not interfered with in any way before or during the experiments. Twenty-five different candles were tried, the highest result being 14.34, and the lowest 13.9 candles. These results gave a mean value of 14.18 candles to the 2½-inch flame; and they showed conclusively that candles could be obtained that would give uniform results, and, further, that a 2½-inch flame of common coal gas in a "London" Argand produced the same amount of light no matter whether the quality of the gas was 15.5 or 17 candles. Mr. Young here mentioned that he had tested 2½-inch flames of Pintsch's oil gas of 38 and 40 candle power, and of carbureted coal gas of 18 and 20-candle power respectively, and obtained the same results; but with Steenbergh's carbureted water and coal gas enriched by petroleum, instead of cannel coal as in Mr. Good's process, the results were much higher.

The author next employed candles without having regard to the condition or the shape of the wick. Three candles were cut in halves and burnt in the usual way. Directly the wicks glowed the test was commenced, and as soon as it was completed they were extinguished by blowing out. Four tests were taken with each candle; at least an hour's interval being allowed between any two tests with the same candle. The results with No. 1 candle were: 15.84, 15.08, 14.51 and 14.35 candles. With No. 2: 15.03, 14.87, 14.29 and 14.25 candles. With No. 3: 16.32, 15.76, 14.8 and 14.36 candles. These figures showed a variation in candle No. 1 of 1.49; in No. 2 of 0.78; and in No. 3 of 1.96 candles in the value given to the gas flame. The author called attention to the fact that the result diminished as the candle burned away, until, at the fourth test taken with them, it approached to the mean value given to the gas flame by the experiments previously alluded to. In order to ascertain whether or not, after the third test with the candle, the results continued uniform, three candles were taken and used in the same way as the others; but the tests were continued until the whole candle was consumed. It was found that with care eight tests could be obtained from one candle. From the results of the experiments the author quoted the following: (1) Highest, 15.9; lowest, 14.01; and mean, 14.65 candles. (2) Highest, 15.68; lowest, 14.97; and mean, 14.72 candles. (3) Highest, 15.03; lowest, 13.94; and mean, 14.38 candles. Exactly the same result was shown as in the last experiments—viz., that the first four tests were much higher than the others, and that when the real value of the gas flame was approached, the results did not afterwards vary greatly. An examination of the wicks of these several candles revealed the cause of the excessive results given in the earlier tests, as in every case they were rough either with deposited carbon, or loose fibers, or both; and the worse they were in this respect, the higher the result obtained. By carefully trimming the wicks before use, and gently bending the wick down until the top was within ⅛ in. from the candle, the candles were brought into a condition similar to that in which they were found after being used several times.

Some experiments were next described with wicks carefully trimmed and regulated. Six candles were taken of the same make as those previously used (Miller's candles, with wicks containing 23 threads in each strand), and eight tests, or as many as possible, obtained with each; the highest, lowest, and mean results being: Candle No. 1: Highest, 14.3; lowest, 13.94; and mean, 14.11 candles. No. 2: Highest, 14.22; lowest, 13.9; and mean, 14.1 candles. No. 3: Highest 14.64; lowest, 13.88: and mean, 14.17 candles. No. 4: Highest, 14.6; lowest, 13.92; and mean, 14.10 candles. No. 5: Highest, 14.35; lowest, 13.9; and mean, 14.15 candles. No. 6: Highest, 14.54; lowest, 13.86; and mean, 14.06. It will be observed, said Mr. Young, that these figures were much closer than in the former experiments, and that the enormous variations disappeared. He thought it worthy of especial notice that the mean result obtained with each candle was practically the same; showing that, at any rate with this particular make of candle, really uniform results might be obtained when the precautions he had indicated had been observed. In order to ascertain whether other varieties of candle would give similar results, he obtained samples of the candles used for the official testings at various provincial gas works, and tested them against a 2½-inch gas flame, having previously prepared and regulated the wicks. The experiments were made with wicks containing two strands of 22 threads and one of 23; with wicks containing 21 threads in each strand; with wicks containing two strands of 23 threads and one of 22; with wicks containing 18 threads in each strand; with wicks containing 21 threads in each strand; and with wicks containing two strands of 21 threads and one of 22. A large number of figures showing the results obtained were given by the author; and they prove that the results were practically the same with each variety—the mean results being remarkably close to the mean value given to the gas flame. He specially pointed out that the candle with the least number of threads in its wick burned the largest quantity of sperm, which was the reverse of what he had expected. This, no doubt, was caused by these wicks being more loosely plaited than in the others. Comparing the results obtained with the sperm burned, experiments showed very clearly that the quantity consumed had little or no effect upon the result; or, in other words, that the light given by the candles was proportionate to the sperm burned within the range shown. The highest consumption of sperm was 45.4 grains, and the lowest 36.3; the values given to the gas flame being 14.24 and 14 candles respectively. In considering the bearing these results had upon the methods at present in use at the Metropolitan testing stations with regard to the candles, Mr. Young said that up to April,

1889, the Gas Referees permitted the Examiners to use the same candles for the three daily tests, the average of which represented the illuminating power of the gas for the day; but since that date, they had ordered that different candles should be used for each test. The effect of this was, he said, that two Examiners testing the same gas might obtain totally different results; for if one worked with three fresh candles, he would report the gas as 1½ candle power higher than another who employed candles which had already been used several times. Under the old regulations, a better average of the candle was possible; and, as a consequence, disputes were less frequent.

The next experiments of the author were made in accordance with the suggestions in the letter to the *Journal* previously referred to; and the wicks were further assisted to burn into proper condition by gently bending them downwards when necessary, and removing all loose fibers. The candles were all of the same make as those recorded in the first four sets of experiments. Six tests were made with each candle; this being as many as could be conveniently obtained; and at least an hour's interval elapsed between any two tests with the same candle. The highest, lowest, and mean results were as follows: Candle No. 1: Highest, 14.35 candles; lowest, 13.94; and mean, 14.2 candles—the consumption of sperm varying from 43.7 to 40.3 grains in ten minutes. No. 2: Highest, 14.38; lowest, 13.94; and mean, 14.14 candles—the consumption of sperm varying from 41.7 to 39.1 grains. No. 3: Highest, 14.47; lowest, 14.02; and mean, 14.25 candles—the consumption of sperm varying from 41 to 38.3 grains. No. 4: Highest, 14.26; lowest, 13.98; and mean, 14.1 candles—the consumption of sperm varying from 41 to 39.2 grains. No. 5: Highest, 14.08; lowest, 13.94; and mean, 14 candles—the consumption of sperm varying from 41.9 to 40.3 grains. No. 6: Highest, 14.48; lowest, 13.91; and mean, 14.24 candles—the consumption of sperm varying from 43.6 to 40.8 grains. The means of these tests were equally uniform with those in the previous ones; and they showed that the number of tests necessary to ensure a reliable result might be reduced to six. If this method were adopted at the public gas testing stations, it would double the work of the Examiners; but the results of the experiments, the author thought, showed that an average of three tests by this method gave equally satisfactory results. The tests as regarded the position of the wicks in relation to each other, and the interval elapsing between each test, were all taken in strict accordance with the Gas Referees' latest notification; and assuming that they were the official tests for the several days, the results he said would be recorded as follows: First day, 14.23 candles; second, 14.19; third, 14.15; fourth, 14.34; fifth, 14.10; sixth, 14.20; seventh, 14.13; eighth, 14.12; ninth, 14.07; tenth, 14.24; eleventh, 14.01; twelfth, 14.12 (mean of two tests). These figures showed a maximum variation of only one-third of a candle in the illuminating power of the gas flame in twelve days' work. It might reasonably be supposed that the 2½-inch gas flame employed varied slightly in illuminating power from time to time; but even if it was assumed to have been absolutely invariable, and the whole of the difference in the results attributed to the candles, these experiments proved that sperm candles would give very satisfactory results.

The outcome of these experiments led the author to suggest that the candles should always before use be brought into a uniform condition as regarded shape and state of the wick. The shape he adopted was that which they naturally assumed in the majority of cases after the candles had been burnt and extinguished three or four times. This shape was generally retained as long as the candles lasted, if they were only burnt long enough for the tops of the wicks to glow before commencing a test, which was from 10 to 15 minutes, and were extinguished immediately the test was completed.

In all the experiments with 2½-inch flames, only two different chimneys were used; they were of the same color, thickness and dimensions, and invariably placed in the same position on the burner, so as to present the same face to the disc in each experiment. In Mr. Young's official tests a different chimney was always used for each; and it occurred to him that the discrepancies might be due to the chimney. His stock of chimneys were all of a smoky brown color. They varied very much in thickness and internal diameter; and not one was perfectly cylindrical. The results of some experiments with thick and thin chimneys, varying in thickness from $\frac{1}{8}$ to $\frac{1}{16}$ of an inch, were quoted by the author, who mentioned that special care was taken with the candles. The results, given in the order in which they were recorded, were as follows: With thick glass 15.53 candles, thin 15.93; thick 15.94, thin 16.68; thick 15.48, thin 16.28; thick 15.85, thin 16.53; thick 16.09, thin 16.65; thick 16.08, thin 16.50; thick 16.77, thin 17.48; thick 15.43, thin 16.36; thick 15.98, thin 16.36; thick 16.06, thin 16.63; thin, 16.83, thick 16.34; thin 16.68, thick, 16.17; thin 16.55, thick 16.10. These figures showed that the thickness of the glass had a considerable effect on the illuminating power. In order to see if the color of the glass had anything to do with it, comparative tests with thick and thin brown glass and thick very pale amethyst glass chimneys were also made. The amethyst chimney was thicker than the thickest brown one, and was more cylindrical. The results were as follows: Thin brown 16.48, thick amethyst 16.24; thick brown 15.23, thick amethyst 16.0; thick brown 15.85, thick amethyst 16.42; thick brown 16.02, thick amethyst 16.79; thick brown 15.68, thick amethyst 15.90, thin brown 16.12; thick amethyst 16.24, thick brown 15.65, thin brown 16.47. The color and thickness of the glass, these experiments showed, were very important when accurate work was to be done. The dimensions and shape of the chimney were, the author maintained, of great importance, and the subject, he said, should not be left in its present uncertain state. It seemed to him that the internal measurement of the chimneys was the proper one to take; but Mr. Sugg contended that it should be the external.

The next portion of the paper was devoted to some details of tests for 18 days made by Mr. Young, officially at the Jewry Street (City) testing station; the results of the tests being recorded in the order of the heights of the flames. The figures appeared to indicate that variations in the results were not due to the candles, but attributable to the difficulty of exactly measuring the flames. The figures also showed that, with the shortest flame (2.9 inch), the results were most uniform; but with the longest (3.1 inch) the least uniform.

The author said he thought that he had shown conclusively (1) That standard sperm candles might be relied on to give fairly uniform results if due regard was paid to the condition as well as shape of the wicks before commencing an experiment. (2) That the light candles gave was practically proportionate to the sperm burnt, far outside the limits fixed by the Gas Referees. (3) That the glass chimneys used with the test burners should be uniform in color and thickness in order to obtain accurate results.

In concluding his paper, Mr. Young mentioned some experiments made with Harcourt's 16-candle standard. He reminded those present that, in the early part of the paper, he stated he had found that 2½ inch flames of coal gas, carbureted coal gas (*i. e.*. coal gas passed through cold petroleum spirit as in Lowe's carburetor, or hot as in Maxim's), and of Pintsch's oil gas, all possessed the same lighting power; but that a similar length of flame of Steenbergh's carbureted water gas, or of coal gas enriched with petroleum oil, instead of cannel coal, as in Good's patent, gave much higher results, as experiments showed that with Steenbergh's gas the 2½-inch flame equalled 18 candles, and that gas obtained by Good's method equalled only 15 candles. In view of the fact that carbureted water gas was now being made and supplied in England, either alone or mixed with coal gas, it was important to know whether standards of light such as the one under notice were effected by the substitution of such gas for common coal gas. Harcourt's 16-candle standard consisted of a "London" Argand burner over which a screen was fixed at a definite height above the top of the burner. The gas was turned on at the rate of 4.5 cubic feet per hour; and sufficient of the gas was then passed through a carbureter containing pentane to produce a flame about 3 inches in length, or until the tips of the flame were seen in a deep-hole pierced in the screen. Mr. Young mentioned that by the kindness of Mr. Heisch, who lent him the Harcourt standard, and of Professor Lewes, who placed at his disposal the gas and photometer at Steenbergh's carbureted water ges works, at Knightsbridge, he was enabled to test the standard when burning carbureted water gas. The apparatus was set up in the photometer in place of the test-burner, and tested against candles. The gas used was of a value of 18.2 candles; and tests were taken with the following result: (1) 17.58, (2) 17.80, instead of 16 candles. Therefore gas of this character, when tested by candles would be returned of only 16 candle power; and it was evident from the results of this experiment that these would be unsuitable for testing carbureted water gas. For a mixture of coal gas and Meeze's water gas he had on several occasions found that a jet photometer indicated 16 candles, when the quality had really been a little above 18 candles. He had no doubt this would be the case in all other standards of light such as Methven and Sugg's 10-candle standard.

ACCORDING to a recent issue of the Newburgh (N.Y.) *Journal*, President Adams, of the Consumers Gas Company of Newburgh, has awarded contracts for plant enlargement that will amount in value to $50,000. The principal item in the plans is that which provides for the construction of a gasholder rated to contain 150,000 cu. ft. The holder will rest in an iron tank. Messrs. P. Delaney & Co., local manufacturers, will do most of the work. The plans also call for a new brick building to house additional purifying apparatus, etc.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

MR. JOSEPH B. CROCKETT, President and Engineer of the San Francisco (Cal.) Gas Light Company, sailed for Europe, per steamship City of Paris, on Wednesday last. He will remain abroad for some time. A very pleasant send-off was given him some days before his departure in the shape of a dinner at the Lotos Club, this city.

MR. H. H. WHITE, formerly Superintendent of the Americus (Ga.) Illuminating and Power Company, resigned that berth in order to assume charge of the plants of the Belleville (Ills.) Gas and Electric Light Company, vice Harry McGuire, resigned.

WE are indebted to Mr. T. A. Bates, Secretary and Superintendent of the Portsmouth (O.) Gas and Electric Company, for the following:

PORTSMOUTH, O., Sept. 10, 1891.

On Sunday, 6th inst., followed by a large concourse of his sorrowing relatives and friends, was laid to rest our dear old friend and confrere, Richard Salter, late Superintendent of the Covington (Ky.) Gas Light Company. He died on the 2d inst. from softening of the brain. Mr. Ranshaw, of the Stacey Manufacturing Company, Mr. Joseph Light, of Dayton, O., the officials of the Covington Company, with other mourning friends of the gas fraternity, were in attendance at the obsequies. After service at the house, the Masonic body took charge and the ceremonies at beautiful Highland Cemetery were appropriate and impressive. Brother Salter was a worthy Mason for 23 years, *living* the principles of the order. A sketch of his life, gleaned from his family, and from personal knowledge, too, may be appreciated by his many friends. He was born at Salop or Shropshire, England, July 22d, 1819, and learned the trade of machinist and engine builder, some of the largest engines of his day bearing the impress of his handiwork. About 1853 he became interested in the gas business, emigrated to America in 1854, and was one of the pioneers in the West in the erection of gas works, being superintendent of construction at many. Among others may be mentioned those at Rockford, Bloomington, Ottawa and Freeport, Ills., Beloit, Wis., St. Joseph, Mo., Circleville, O., and Vincennes, Ind. At the latter place he was probably the first to supply a town with gas while the holder was unfinished, doing this to make good the word of the contractor, Mr. R. T. Coverdale. In 1860 he took charge of the Paducah (Ky.) works, remaining at his post until they were destroyed during one of the battles of the rebellion. Here his loyal blood shone forth in the second generation; his eldest son, John, on entering the fort with the Union troops, fought until killed. Early in 1864 he took charge at Evansville, Ind., and in February, 1885, assumed control at Covington, Ky., retaining the position until failing health constrained him to resign, in the fall of 1888. He was succeeded by his worthy son, James. My acquaintance with Brother Salter began early in 1862, while on our way to Fort Donelson, and continued since. He was a man singularly modest and unobtrusive, rather averse to large assemblies, and little given to expressing his opinions or ideas in public; but with a social few he was never at a loss to expound his views on any topic, and his judgment was sure to be sound. As a husband and father he was kind, indulgent and provident; as a friend, cheerful, generous and true; as a man before the world he was all that the word man implies. Peace to his ashes. Would that the world held many more like him.

MR. R. W. BUSH is in charge as Superintendent of the South Boston (Mass.) Gas Company's works.

THE officers of the Mechanicsburg (Pa.) Gas and Water Company for the ensuing term are: President, J. O. Saxton; Secretary and Treasurer, J. O. Myers.

MR. GEORGE A. DRESSER, father of the late Capt. George Warren Dresser, died at his home, Fair Lawn, Abington, Conn., on the morning of the 14th inst. The funeral services were held on the afternoon of Wednesday, Sept. 16th. Deceased had for many years been prominent in fire insurance circles, and just previous to his retirement from active business was Manager of the Agencies Department in this country of the Queen Insurance Company. He lived to a good old age, and with its close a life of honor and usefulness was rounded out.

THE following correspondence explains itself:

OFFICE OF AKRON GAS COMPANY,
AKRON, OHIO, Sept. 10th, 1891.

To the Editor AMERICAN GAS LIGHT JOURNAL: Can you give us any information relative to the use of compressed oxygen and its value in the case of persons overcome with gas? I presume you have many such inquries since its recent reported use in England; but if you can give me, through the columns of your paper or otherwise, the address of parties of whom it can be obtained, in a form such as we can use, and your opinion as to the value of it, I will feel greatly obliged.

Very truly yours,
ERNEST F. LLOYD, Secy.

SINCE the publication (See JOURNAL August 24th, 1891, p. 264) of the experiment of Colonel Henry Elsdale in employing pure oxygen in a highly compressed state, to restore to consciousness a sapper serving under him in the British Royal Engineers, who had been prostrated by inhaling coal gas, we have received six inquiries, all similar in matter to the one given above. It is our own belief that the practice advised by Col. Elsdale would be most efficacious, and in this opinion we are supported by the testimony of eminent physicians of this city. The difficulty of applying the remedy, owing to the method of storing the oxygen followed by the makers, could be obviated were the suggestions as to a proper retaining vessel offered by Col. Elsdale followed out; and it is likely that the manufacturers will give to his plan their early attention. The New York Oxygen Company, whose works and office are on First avenue, near 21st street, this city, kindly furnishes us with the following tables and price list of its system of putting compressed oxygen on the market:

Steel Cylinders of Compressed Oxygen.

Cubic Contents, at 120 Atmos Cu. Ft.	Diameter, Inches	Length Over All, Inches.	Approximate Weight, Pounds.	Prices of Cylinders.	Rent per Week, After Two Weeks.	Prices per Cu. Ft. in Company's Cylinders.	Prices in Customers' Cylinders.
10	4.0	19.5	10	$10	20 cts.	On application	On application
15	4.0	25.5	13	11	20 "		
20	4.0	32.5	23	12	20 "		
40	5.5	33.5	38	14	25 "		
60	5.5	47.5	50	17	25 "		
80	5.5	61.5	66	21	40 "		
100	5.5	76.5	81	27	40 "		

The price list of fittings, etc., is as follows: Nipple and union, 75 cents; keys, 25 cents; regulators for controlling the flow of gas at a uniform pressure, $12; gauges for showing quantity of gas in cylinder, $12; connector for simultaneously coupling both gauge and regulator to cylinder, $1.50; inhalation bags, $2.50.

MAURICE C. GIMPEL has brought suit against the California Electric Light Company, of San Francisco, for $5,000 damages. Complainant, who is a sign painter, asserts that on February 11th, 1891, he was engaged in painting a sign on the exterior of Waller's Pharmacy, corner of Geary street and Grant avenue, when, "without warning," he received a shock from the wires of the defendant, the conductors which supplied electric light to the pharmacy having been stripped of their insulating material because of the Company's failure to keep its lines carefully inspected. As a result of the "shock," he was unable to work for some weeks, and his "nervous system was seriously impaired."

THE Electric Lighting Station at Emaus, Lehigh County, Pa., was recently destroyed by fire, and the town is in darkness.

THE Board of Aldermen, of Batavia, N. Y., has decided to accept the proposition tendered several weeks ago by the Consolidated Gas and Electric Light Company to maintain all public lights on the basis of an every night and all night schedule. There are 72 lights, and the extra cost per annum over the old system will not exceed $1,800.

THE street gas illuminations in St. Louis, Mo., during what might be called the annual harvest show, in that city, are attracting much attention. Mr. John S. Moffit, of the Illumination Committee, is our authority for the following particulars respecting the scope of the lighting. "There are 50,651 jets covered by an equal number of globes. If the illuminating fixtures, exclusive of the arches, were placed in a straight line, they would extend for eight miles. The lights are about one foot apart, hence there would be in each mile 5,280 lights. In eight miles then, there are 42,240. There are 42 arches, each carrying 150 jets, making an extra number of 6,300. The incidental lights on buildings, etc., bring the total up to the number stated above. The Committee expects to lose 10,000 globes by breakage, etc., each year. This allows for hailstones, tornadoes, whirlwinds, cyclones, bad boys, frightened horses, clumsy workmen, and falling fixtures. However, to guard against the wholesale breaking of arches, the Committee has a reserve of 50,000 globes. So far, this year, only 500 have been broken. The lights in one block are all turned on at a time, when two or three men

go through the block with torches and light the jets at a swift rate. Forty men do the job, and these men can light 12 or 15 blocks in as many minutes. As there are no keys on the jets the torchman only needs to run his torch along the jets. If the arches were put in a line they would extend for over a quarter of a mile. Each jet burns about 6 cubic feet of gas each night, so there are 300,000 cubic feet of gas used every illumination night, and the entire cost of the illumination will be about $50,000."

MR. GEORGE W. GATEHOUSE, who enjoyed the distinction of being considered the most urbane collector on the staff of the Fulton Municipal Gas Company, of Brooklyn, N. Y., has been promoted to the position of application clerk.

THE Attica (N. Y.) electric light plant was sold early this month at sheriff's sale. It was purchased by Paul T. Brady, acting on behalf of the Thomson-Houston Company.

ADVICES from Louisville, Ky., are to the effect that the Louisville Gas Company's electric lighting plant will go into operation on October first. The contract for the public arc lighting between the city and the Company provides that the Gas Company shall furnish the city with 159 arcs of 2,000 candle power each, or more, as shall from time to time be ordered; the lights to burn each night in the month from one-half hour after sunset to one-half hour before sunrise. For every hour that the lights are not burning between the stipulated times the price of two hours burning shall be taken from the contract price. The lamps are to be hung over the centers of streets, at a height not less than 25 feet nor over 35 feet from the ground. The contract price per annum for each light is $66.

IT may be that the Gas Company sees its way clear towards making a living profit on these lamps, of 2,000 candle power, at the specified rate, but at this distance from the ground of supply it looks as if the Company will have to accept a large portion of its profit from the return that it is working for the public good.

THE Van Wie Gas Stove Company, with headquarters at Rockford, Ills., is said to have failed. The liabilities are placed at $22,000.

IT is asserted that the Borough Council, of Madison, N. J., will refuse to accept the proposition of the Morristown Gas Light Company to extend the gas mains from Morristown to Madison. The ground for the refusal is that the people of Madison want electric lighting; but would it not be good policy to permit them to have both classes of illumination? There would be a lesser flavor of Hobson's choice about it, too.

A CORRESPONDENT at Dubuque, Ia., writes: "Alderman Weiss, of Duluth, Minn., is responsible for the introduction in Councils of that city of an ordinance nominally designed 'to prevent improper excavations on streets and public property;' and while its provisions are, of course, general in nature, it is beyond doubt especially aimed at the Duluth Gas and Water Company. It specifies that any one desiring to make excavations in the streets must first make application for a permit from the Board of Public Works, unless an accident should occur at such a time that excavation must be made before a permit could be secured, in which case permit must be applied for not later than 12 hours after excavation is commenced. Apparently the ordinance does not cover the possibility of an accident on Saturday night, or else the compiler of the ordinance rests under the belief that the Duluth officials are always at their posts. Continuing, the ordinance directs that when 'time comes to make restoration where an excavation is made, the Board of Public Works must be notified, so that a city inspector can see that the work is properly done.' If paving is to be relaid, the work is to be done by the city pavers, or by pavers properly licensed."

"OBSERVER," writing under date of the 14th inst., says: "I note that you make mention of the propable consolidation of the Belfast (Me.) Gas and Electric Lighting Companies, and in connection therewith forward you the following from the Belfast *Age*: 'It is about settled that the Belfast Gas Company will sell its stock to the Belfast Illuminating Company. Now that there is a possibility of a change being made, a brief mention of the Gas Company may not be out of place. In 1858 Hiram O. Alden and others organized the Belfast Gas Company with a capital of $20,000. The works were erected the same year, at the corner of Washington and Market streets, and gas was first sent out on Nov. 23, 1858. The Company started with 90 consumers, who were supplied with gas made from rosin, at a charge of $7 per 1,000 cubic feet. In the summer of 1862, owing to the war of the rebellion, the supply of rosin was cut off, whereupon the plant was changed to manufacture gas from coal. In all that time there have been but two Superintendents. The first was W. H. Burrill, who held the position for 8 years, when he was succeeded by A. K. Pierce, who is still in charge after a service of 25 years. In Mr. Pierce's first year 807,900 cubic feet were sold, the consumption gradually increasing up to the present time. Last year the output was 1¼ million cubic feet. In the first half of this year the gain over the corresponding six months of 1891 was 11 per cent. Cooking by gas has found great favor with the residents, 33 per cent. of the output being now used for this purpose. In 1865 the gas rate was $4.50, plus 12 cents per 1,000 government tax. Now it is $2.50 per 1,000 cu. ft., with 25 per cent. off to those whose gas bills are in excess of $5 per month. The Company has never had to pay a penny on account of damages to person or property. The night man in the works, Otis K. Reynolds, has been with the Company for 21 years. The Directors are: C. B. Hazelton. W. B. Swan, A. A. Howes, N. F. Houston, and John H. Quimby.'"

MR. B. F. HARDING, Treasurer and Superintendent of the Bridgeton (N. J.) Gas Light Company, writing under date of the 15th inst., says: "I was very much interested a few moments ago reading the article in your last entitled 'A Very Satisfactory Showing,' and its perusal led me to compare our own consumption. I find our increase is just 8 per cent., without any decrease in price or anything else from the ordinary consumption. We think that is encouraging when we take into consideration the opposition that we have to contend with from electric lights and other modes of illumination. Our new holder, being erected by Messrs. R. D. Wood & Co., will be ready for use about November 1st, which will more than double our present holder room and give us a comfortable margin beyond our heaviest consumption. We have needed this holder for several years, but did not know just what effect the electric light was going to have on our business, and so deferred the erection until this season."

THE Concord (N. H.) Gas Light Company has ordered from the Thomson-Houston Company electric apparatus rated to maintain 1,200 incandescent lights of 16-candle power each.

THE dimples on the handsome face of Mr. Hayward, of the Connelly Iron Sponge and Governor Company, are coming and going with great vim these days, and there is little wonder that he should be smiling and contented. Orders brought to book are most reassuring reminders that one is well in the swim, riding safely over the breakers of business competition. The following list of recent orders for the Company's iron sponge specialty is given to show why Mr. Hayward smiles:

Name of Purchaser.	Lots Purchased.
Cincinnati (O.) Gas Light and Coke Co.	6 car loads.
Philadelphia (Pa.) Gas Improvement Co.	3 "
Equitable Gas Co., New York city.....	8 "
Louisville (Ky.) Gas Co.....	18 "
Fulton-Municipal Co., Brooklyn, N. Y.	2 "

A PROPOSITION looking to the consolidation of the Youngstown Gas Company, the Mahoning Electric Light Company, and the Youngstown Incandescent Light Company, all of Youngstown, O., is being considered by the shareholders in the concerns named, and is likely to be carried to completion.

HOLLY SMITH, the night dynamo man at the works of the Dallas (Tex.) Electric Light Company, was instantly killed by an electric shock, through careless handling of the apparatus.

AT the special election held at Little Falls, N.Y., to determine whether the Board of Trustees would be authorized to raise the sum of $10,000 for the purpose of furnishing the village with arc electric lights for a period of one year, 341 votes were cast. Of these 176 favored the project, thus affirming the proposition by a majority of 11 votes. None but taxpayers were allowed to vote.

THE fuel gas promoters at Evansville, Ind., are making poor headway with their attempted strike, Mayor Goodlet having refused to treat with the Company, which chief promoter Genung was obliged to admit was "only partially organized." Evansville will be vastly better off if the Genung scheme never gets beyond the mythical or embryotic state.

THE following account of the 44th annual meeting of the Providence (R. I.) Gas Company, is from the columns of the Providence *Journal*, date of September 11th: The Secretary read the call for the meeting, and the record of the previous annual meeting was read and approved.

The President then read the annual report of the directors to the stockholders, from which the following is taken :

"The year opened with a reduction in the price of gas from $1.40 to $1.30 per 1,000 cubic feet. This reduction was made in the middle of a year when the ratio of increase and production was showing to be less than in the years preceding. It was also made at the opening and in the face of a strike in the large mines whence we derive our principal supply of coal which the owners thought would be of short duration, but which continued for 5 months and which produced such a dearth in the coal market for that period as to give us great anxiety with much trouble and additional expense of at least $20,000 to maintain our supply. It was also made at a time following the most persistent and furious attacks on our franchise before the State Legislature, and which, though defeated for a season, proved not to have been abandoned. But nevertheless, the reduction was made under our standing policy of cheapening periodically the cost of gas to the consumer as far as able to do so, hoping that in spite of these unfavorable and even threatening circumstances that by the improved processes of manufacture in use and in preparation we should be able to save the usual dividend to stockholders while giving this large amount to the consumers. We have done both. The amount of the gas produced for the year up to July 1, 1891, was 485,905,000 cubic feet, an increase of 10,380,000 cubic feet. This is the smallest increase for any one of the last 6 years, but our records show a gross increase for those years of about 132,000,000 cubic feet or about 37 per cent. The receipts for residual products for the year show a decrease of $8,525 for coke, an increase of $5,997 for tar, and for ammonia an increase of $1,444. This shows a reduction in the gross receipts for these products of $984. All these residuals come from the coal carbonized for the production of coal gas. As nearly one-fourth the gas produced last year was water gas, you would naturally look for a proportionate decrease in the amount received for these residuals. The loss is shown in the return for the receipts for coke, which fell off nearly 25 per cent., while for the others the diminished supply has so far advanced the market prices that our returns show a gain of 40 per cent. on receipts for coal tar and nearly 20 per cent. for ammoniacal liquor. The amount of coal carbonized during the year was 35,869 tons, or 4,388 tons less than was used the the previous year. The quantity of crude oil used in carbureting the water gas was 493,253 gallons. The Board has felt it wise to retain both of its coal gas plants intact and in operation most of the year, because better prepared to meet the emergencies liable to arise from short or dear supplies of either coal or oil, and also because we think a mixture of the two kinds of gas better than either alone. The water gas plant at south station was of great advantage to us through the coal famine, it having been run alone several months for the supply of about one-third of the city. During the past year we have laid 26,806 feet of main pipes, or about 5⅛ miles, which gives us a present aggregate of a little more than 173¼ miles in the ground and in use, besides 6 miles of pipe laid by the Citizens Gas Light Company, still in the ground and unused, none of which could be raised the past year without unjustifiable damage to the streets and inconvenience to the citizens. The number of meters now in use is 14,625, an increase of 1,100 over the preceding year, and much the largest increase ever reported for a single year. In our report we advised you that we had contracted for the construction and erection of buildings and machinery for another water gas plant to be located at the west station. The reasons given in our last report for ordering that plant, while good in general, had special force and urgency in view of the strike in the coal mines, then closing the fourth month of its duration and still vigorous. The works were completed and started in April last, and have been in moderate but constant and successful operation since. The following named gentlemen were elected Directors for the ensuing year, viz : Hon. A. C. Barstow, Col. William Goddard, A. B. Slater, Hon. Royal C. Taft, Edward Pearce, Jesse Metcalf, George W. R. Matteson, Lucian Sharpe, Newton Arnold. After the annual meeting of the stockholders the Directors-elect met and organized by the election of the following-named officers, viz. : President, Hon. Amos C. Barstow ; Vice President, Col. William Goddard ; Treasurer, A. B. Slater ; Secretary, A. B. Slater."

Insolubility of Pure Metals in Acids.

The results of an investigation concerning the cause of the insolubility of pure metals in acids are contributed by Dr. Weeren to the current number of the *Berichte*. De la Rive, so long ago as the year 1830, pointed out that chemically pure zinc is almost perfectly insoluble in dilute sulphuric acid. Dr. Weeren's theory of the phenomenon is as follows :

"Chemically pure zinc, and also many other metals in a state of purity, are insoluble or only very slightly soluble in acids, because, at the moment of their introduction into the acid, they become surrounded by an atmosphere of condensed hydrogen, which, under normal circumstances, effectually protects the metal from further attack on the part of the acid."

The experiments from which this theory has been derived were briefly as follows : The amount of chemically pure zinc dissolved by the acid was first determined. It was next sought to determine what difference would be effected by performing the experiment *in vacuo*, when of course the escape of the hydrogen would be greatly facilitated. The solubility was found under these circumstances to be increased sevenfold. Next, the experiment was performed at the boiling temperature of the dilute acid, first when ebullition was prevented by increasing the pressure, and secondly when ebullition was unhindered. In the first case, when ebullition was prevented, the solubility was practically the same as in the cold ; while in the second case, with uninterrupted ebullition, the solubility was increased 24 times. Finally, experiments were made to ascertain the effect of introducing into the acid a small quantity of an oxidizing agent capable of converting the hydrogen film to water. When a little chromic acid was thus introduced the solubility was increased 175 times, and when hydrogen peroxide was employed the solubility was increased three hundredfold. The explanation of the ease with which the metal becomes attacked when the ordinary impurities are present, is that the hydrogen is not then liberated upon the surface of the zinc, but rather upon the more electro-negative impurities, leaving the pure zinc itself open to the continued attack of the acid.

Electricity and Life.

Mr. Edward P. Jackson, in the *North American Review*, indulges in the following respecting what he is pleased to term "Electricity and Life."

It seems to be a pretty well established fact that electricity may be made at least a powerful stimulant to the growth of plants. May it not be more than a mere stimulant? May it not be an actual creator of life? Beans, rye, corn, oats, barley, peas, potatoes, sunflowers, clover, and flax have all been experimented upon, in some cases with astonishing results. In one series of experiments the seeds were electrified before they were sown ; in another, currents were maintained through the soil in which they were planted ; and in still another, through the atmosphere immediately above the plants. In several instances the yield of fruit was enormously above the average, and in all the growth was unusually luxuriant. Further experiments are in progress, and it is not unlikely that science is about to add another to her long series of beneficent triumphs, another refutation to the croaking philosophy of Malthus and his disciples.

The results of the experiments have, furthermore, a suggestive bearing upon the relation between electricity and that inscrutable something which we call life. If they do not prove them the same, they at least bring them nearer together than any phenomena which have preceded them. When, in the healing art, enfeebled vitality is restored, either wholly or in part, by the skillful application of electricity, nothing is positively demonstrated beyond mere healthful stimulation, the mere awakening of life which already lay dormant in the system, such as might possibly have followed the use of other remedial agents. But here it is not morbid restored to normal conditions, not dormant life reawakened to action. It is apparently the actual development of vitality not pre existent in the perfectly healthy and normal organisms under treatment. Electricity itself appears to be converted to vitality, as elsewhere it is converted to light, heat and mechanical motion.

Whether life can thus not only be renewed, but actually transfused into the veins, or rather the nerves, of man remains for physiological science to determine. It has already been shown that a living body is a species of thermoelectric battery, of which the ectoderm and the endoderm are the opposite poles ; that the exhilarating effects of a cold plunge, for example, are due simply to the increase of potential from the reduced temperature of the "cold" electrode. But merely setting a battery into operation, or merely increasing its action, is not increasing its inherent voltage, which is what the recent experiments seem to have done for plants.

But do not heat and the active principle of light artificially intensified produce similar effects? The forcing of vegetable growth in hothouses is an old process, not unlike the one in question, both in method and effect. According to the reports given, however, there is a very great difference in the results attained. If this be true, it would seem to indicate more strongly than ever that, of all forms of natural force, electricity bears the closest relation to that mysterious form of it which we call life.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,

PROPRIETORS.

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AGENTS.

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MONDAY, SEPTEMBER 21, 1891.

TO ADD AN INCANDESCENT PLANT.—The stockholders of the Consolidated Electric Light, Gas and Power Company, of Woodland, Cal., have resolved to run a system of incandescent lights in connection with their present arc electric light and gas plants.

The boiler for a new 100-horse power steam engine has already been placed in position at the electric light works. The capacity of the new plant will be sufficient to furnish 600 lights, and wires will be run to all parts of the city, in order that private residences as well as business houses can be lighted by this system. The cost of this new system will aggregate $20,000.

ADVANCING THE RATES FOR NATURAL GAS.—The Bridgewater (Pa.) Gas Company is laying a pipe from its two gas wells in the Coraopolis field to connect with the East Liverpool mains. The two wells have each a pressure of 500 pounds. The connecting line is to be about 8 miles in length. The Company has recently advanced rates 15 per cent. The advance slightly affects the East Liverpool, O., glass factories, making the rate to them $30 per fire per year.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 WALL ST., NEW YORK CITY.

SEPTEMBER 21.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	98½	99¼
Central	500,000	50	—	90
" Scrip	220,000	—	95	100
Equitable	4,000,000	100	119	121
" Bonds	1,000,000	—	106	108
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	110	115
Mutual	3,500,000	100	118	121
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Standard Gas Co—				
Common Stock	5,000,000	100	—	48
Preferred	5,000,000	100	—	90
Yonkers		50	112	—
Richmond Co., S. I.	346,000	50	—	—
" Bonds	20,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	95	100
Citizens	1,200,000	20	—	78
" S. F. Bonds	320,000	1000	100	103
Fulton Municipal	3,000,000	100	115	117
" Bonds	300,000		100	105
Peoples	1,000,000	10	65	70
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	100	—
Metropolitan	870,000	100	90	95
" Bonds (5's)	70,000	—	—	—
Nassau	1,000,000	25	130	—
" Ctfs	700,000	1000	98	100
Williamsburgh	1,000,000	50	105	110
" Bonds	1,000,000	—	105	109
Out of Town Gas Companies.				
Boston United Gas Co.—				
1st Series S.F. Trust	7,000,000	1000	—	84½
2d " " "	3,000,000	1000	70	—
Bay State Gas Co.—				
Stock	5,000,000	50	—	—
Income Bonds	2,000,000	1000	98	102
Buffalo Mutual, N. Y.	750,000	100	105	110
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	155	160
" " Bonds.	45,000	—	—	—
Chicago Gas Company.	25,000,000	100	52	52¼
Chicago Gas Light & Coke Co.—				
G't'd Gold Bonds	7,650,000	1000	83	83⅞
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1000	—	97½
People's Gas and Coke Co., Chicago—				
1st Mortgage	2,100,000	1000	—	100
2d "	2,500,000	1000	—	100½
Consumers Gas Light Co., Jersey City	2,000,000	100	12	15
Bonds	600,000	1000	70	75
Cincinnati G. & C. Co.	6,500,000	100	207	209
Consumers Toronto	1,000,000	50	169	172
Central, S. F., Cal.			90	—
Capital, Sacramento, Cal			58	
Consolidated, Balt.	11,000,000	100	44	44½
" Bonds	6,400,000		107	107½
Citizens Gas Lt. Co., Rochester, N. Y.	500,000	—	85	110
Bonds	250,000		—	—
East River Gas Co., Long Island City	1,000,000	100	100	105
Bonds	500,000	100	100	102
Hartford, Conn.	750,000	25	109	114
Jersey City	750,000	20	165	170
Louisville, Ky.	2,570,000	50	125	130
Little Falls, N. Y.	50,000	100	—	100
" Bonds	25,000	—	100	103
Laclede Gas Light Co., St. Louis, Mo.—				
Common Stock	7,500,000	100	19	19½
Preferred "	2,500,000	100	—	—
Bonds	9,034,400	1000	—	77¾
Montreal, Canada	2,000,000	100	200	208
Memphis (Tenn.) Gas	750,000	100	40	—
" Bonds.	240,000	100	103	—
New Haven, Conn.		25	200	—
Oakland, Cal.			34¾	35¼
Peoples, Jersey City		—	115	125
" " Bonds.			—	—
Paterson, N. J.		25	99	102
Rochester, N. Y.		50	99	100
Syracuse, N. Y.	500,000	25	—	—
San Francisco Gas Co. San Francisco, Cal.	10,000,000	100	63	63½
Washington, D. C.	2,000,000	20	200	208
Wilmington, Del.		50	88	90

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849-4 "W. S.," care this Journal.

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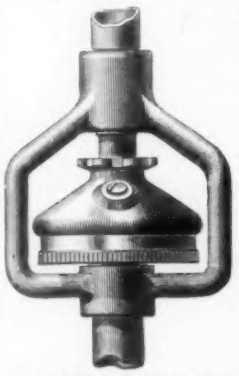

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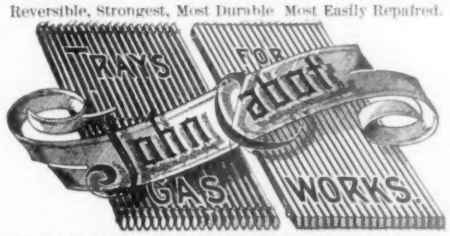

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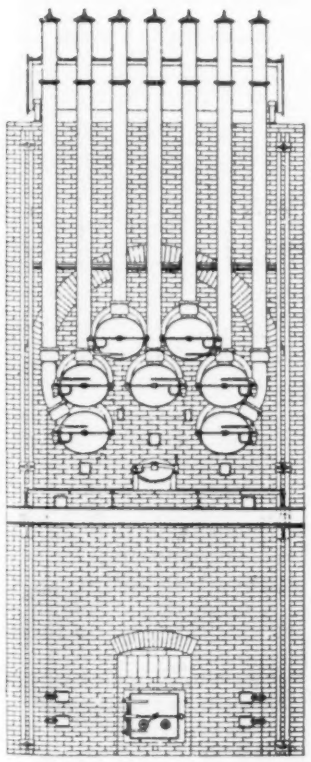

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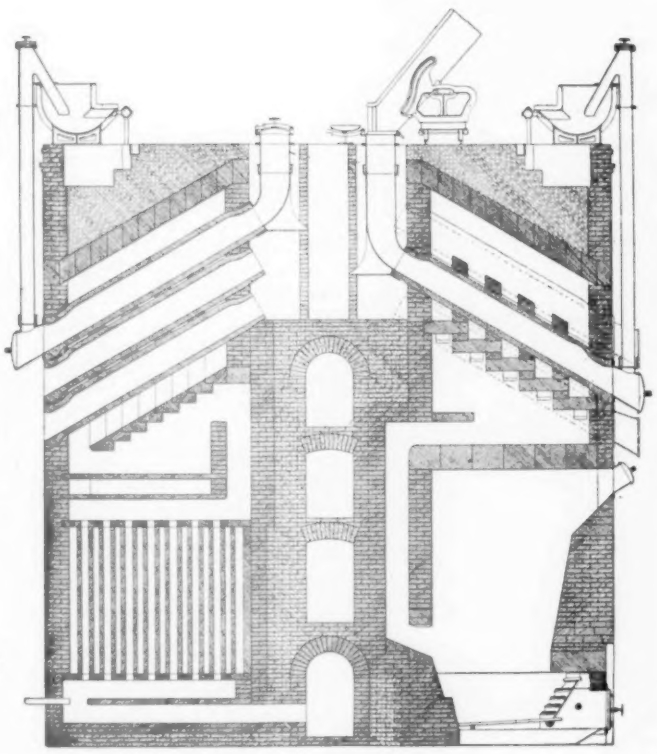

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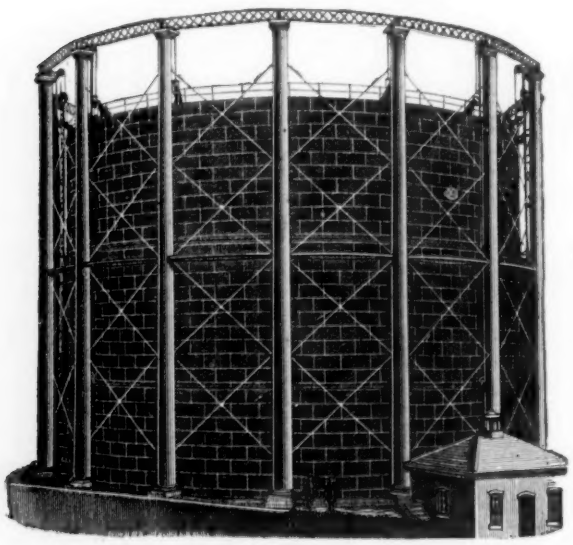

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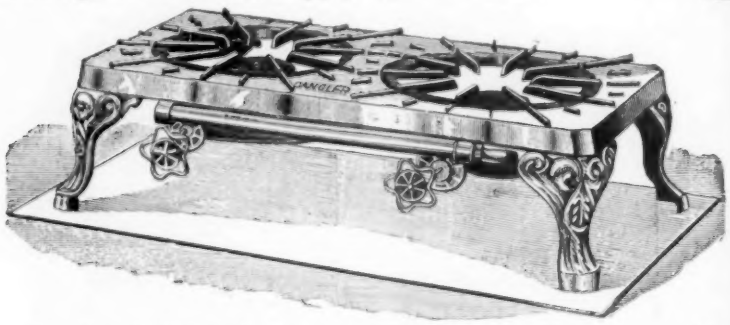

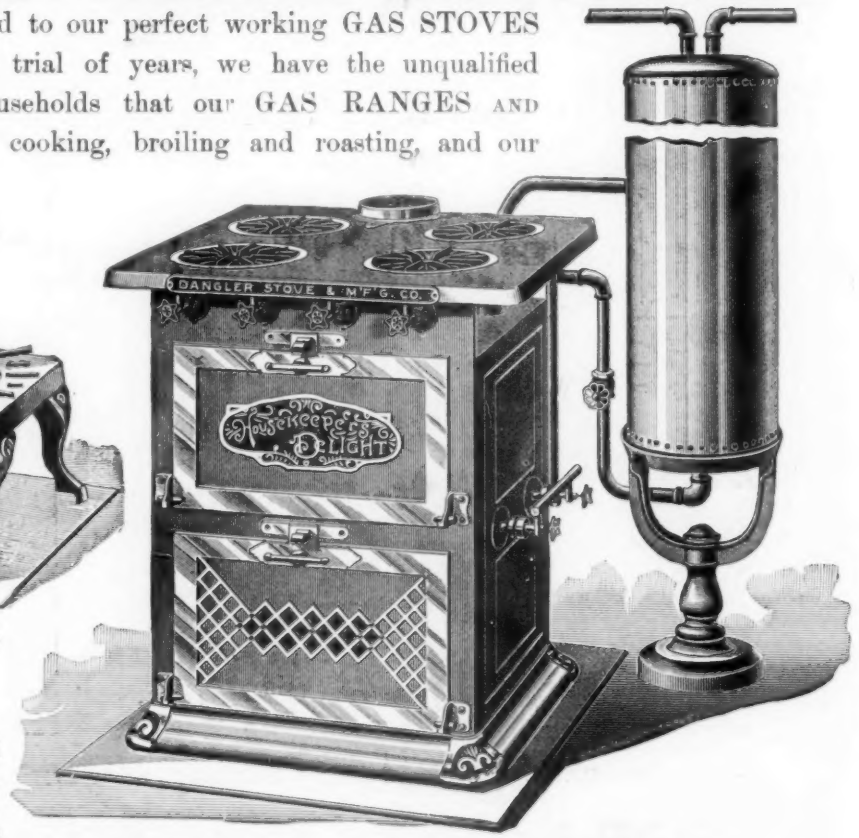

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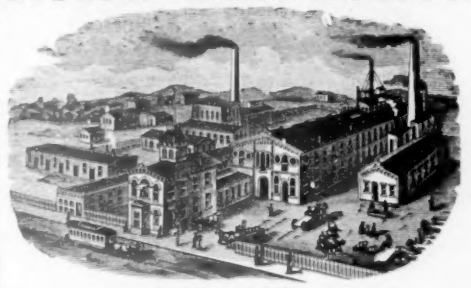

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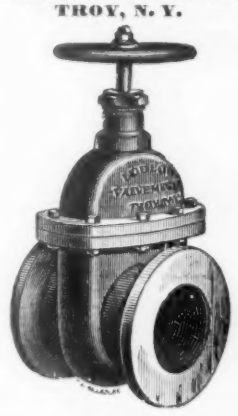

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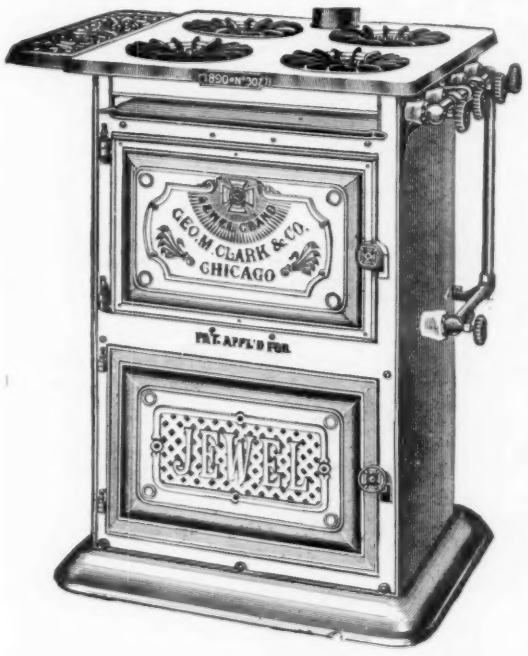

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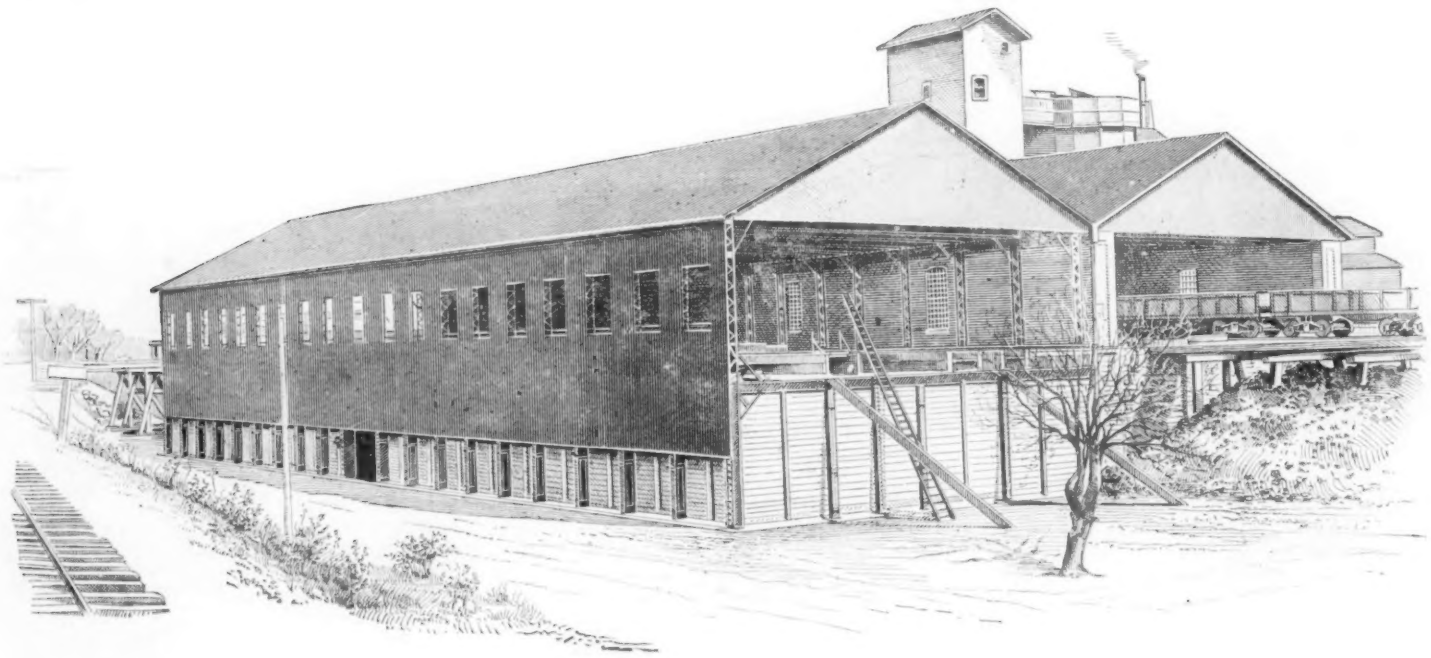

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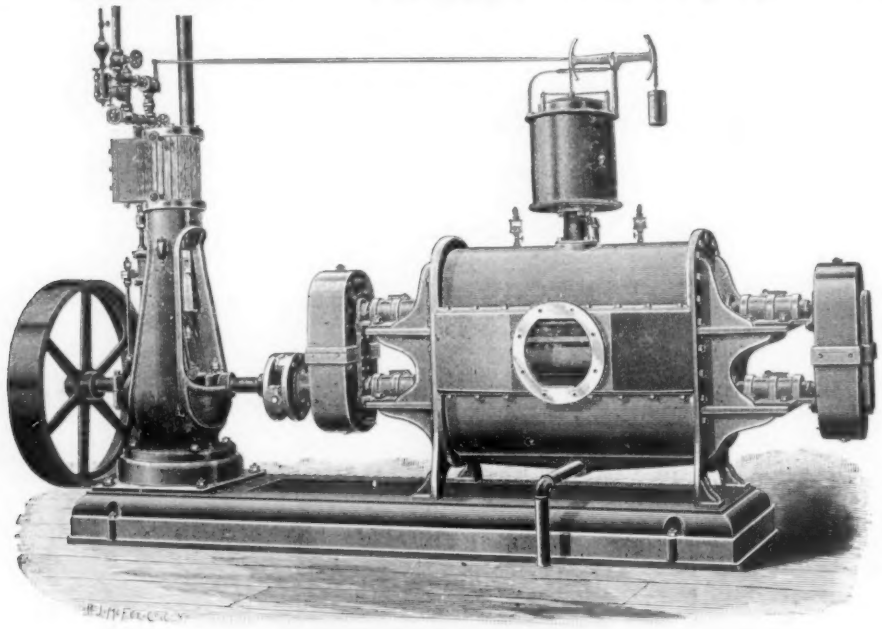

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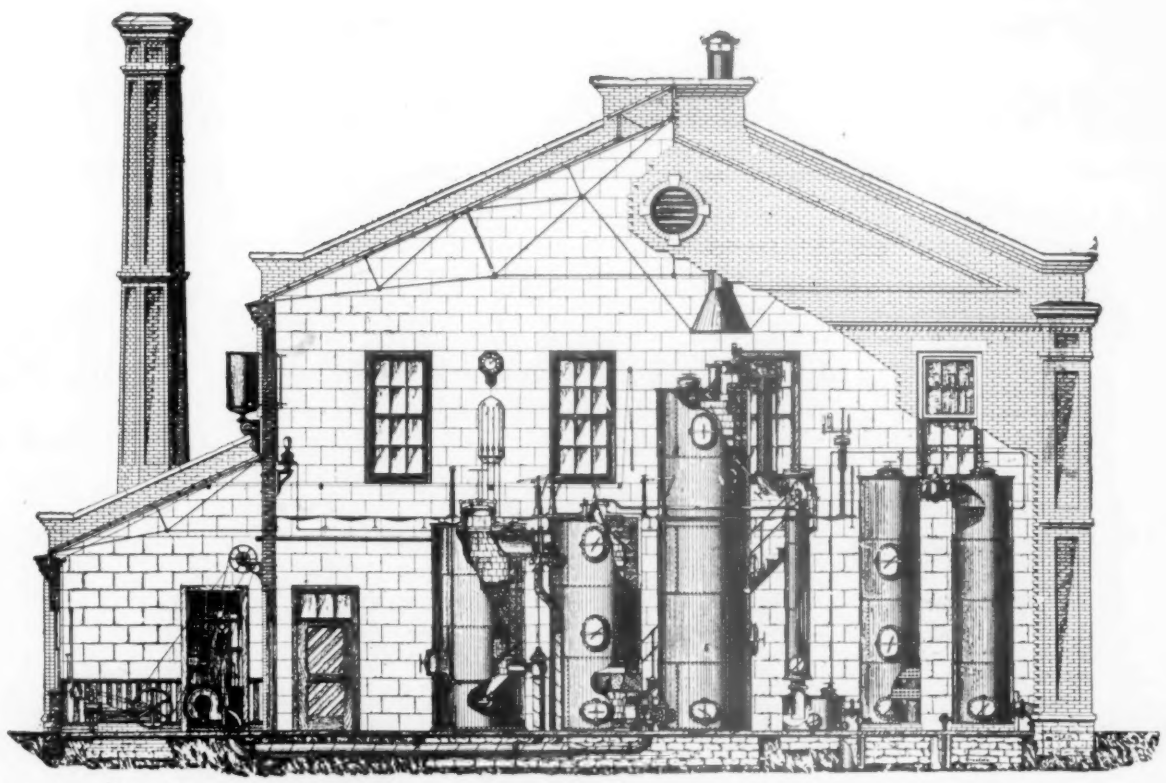

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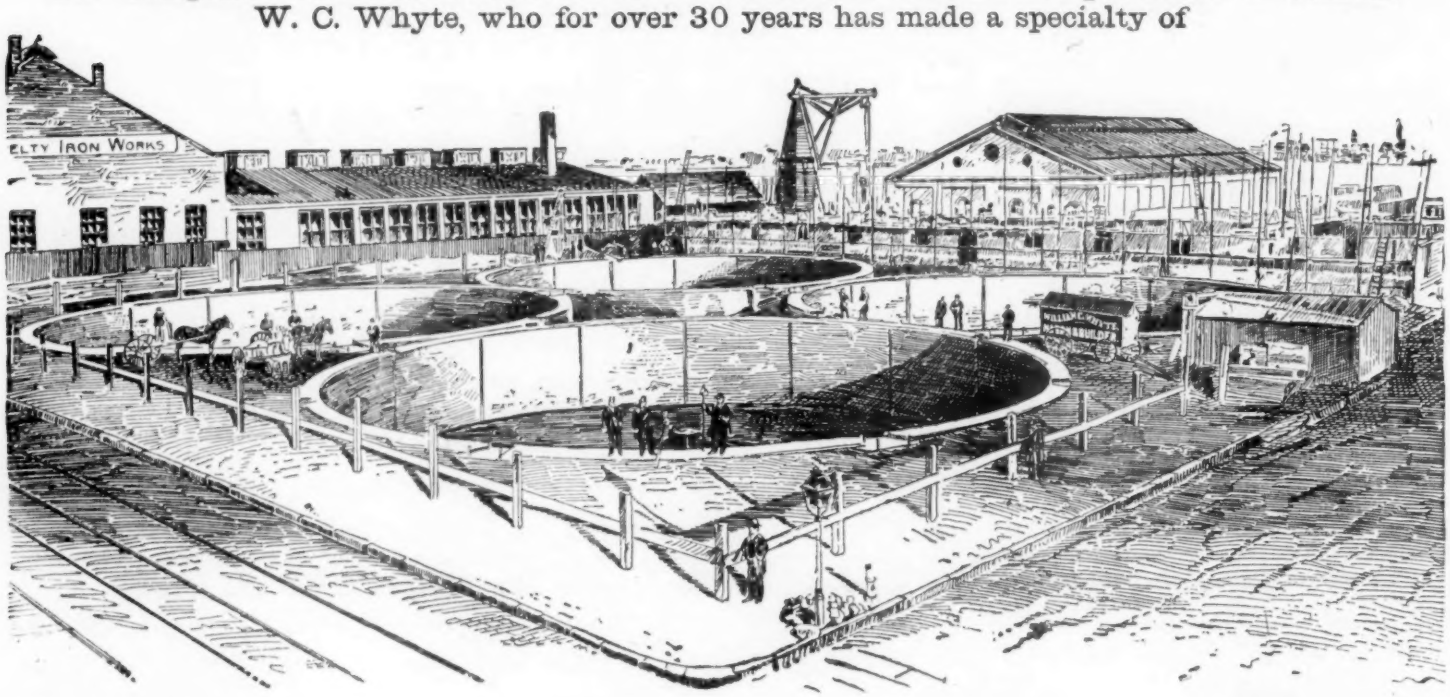

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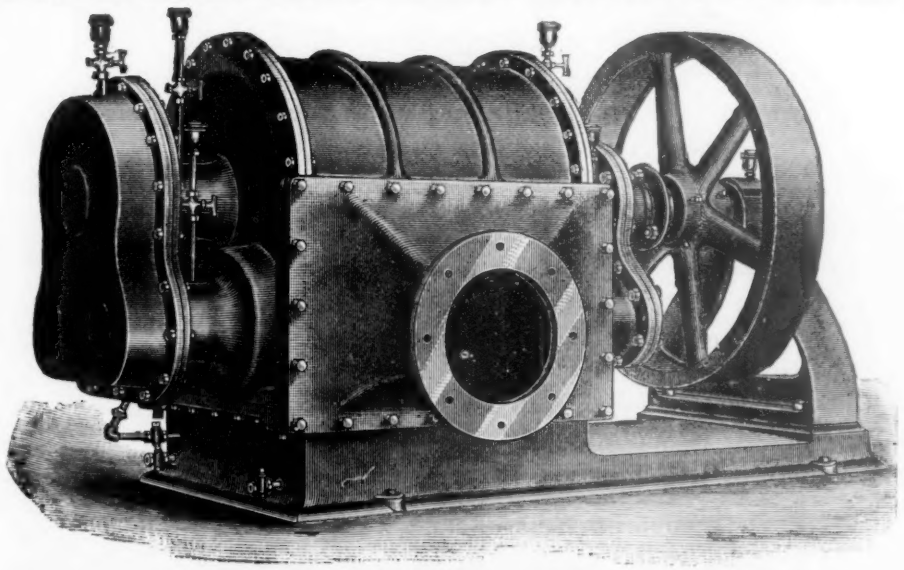

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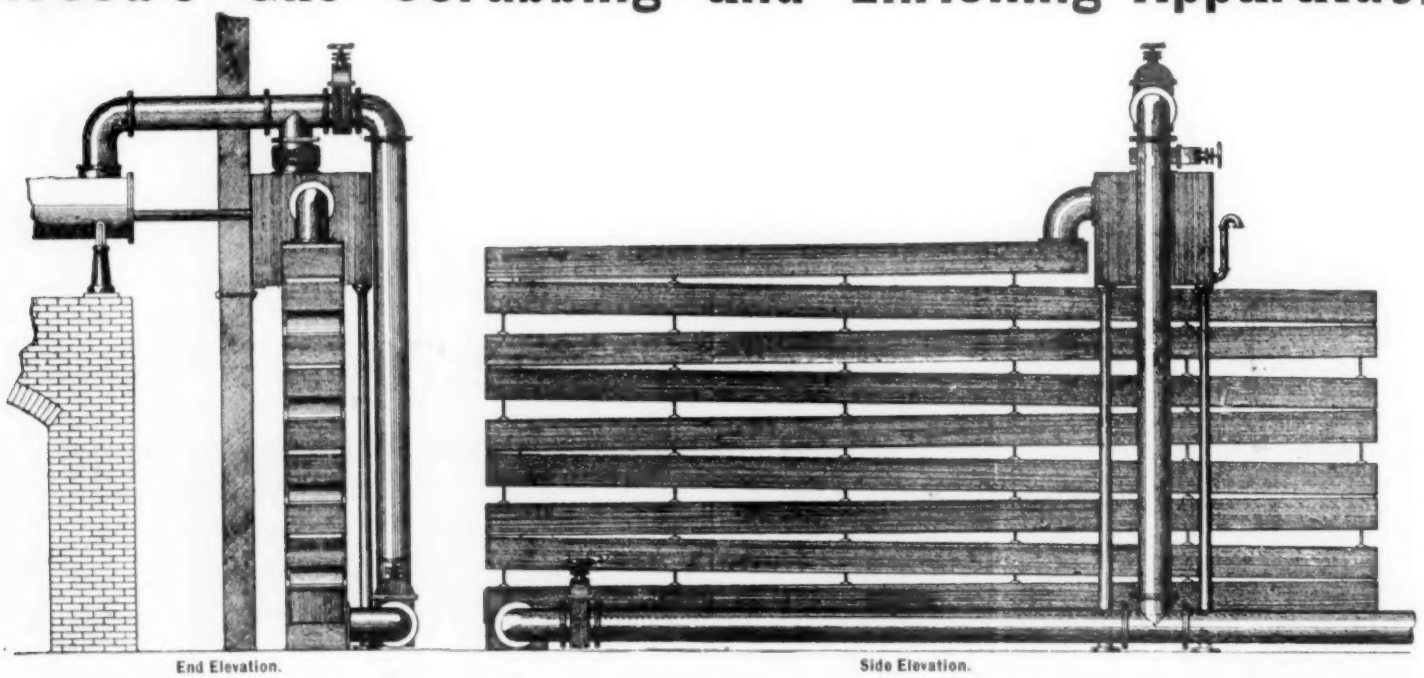

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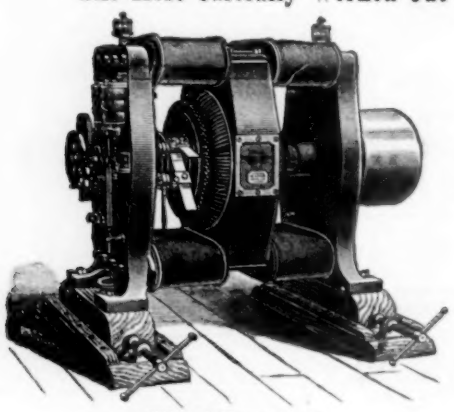

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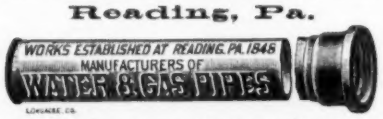

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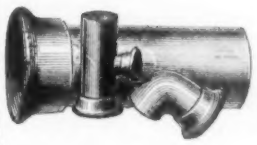

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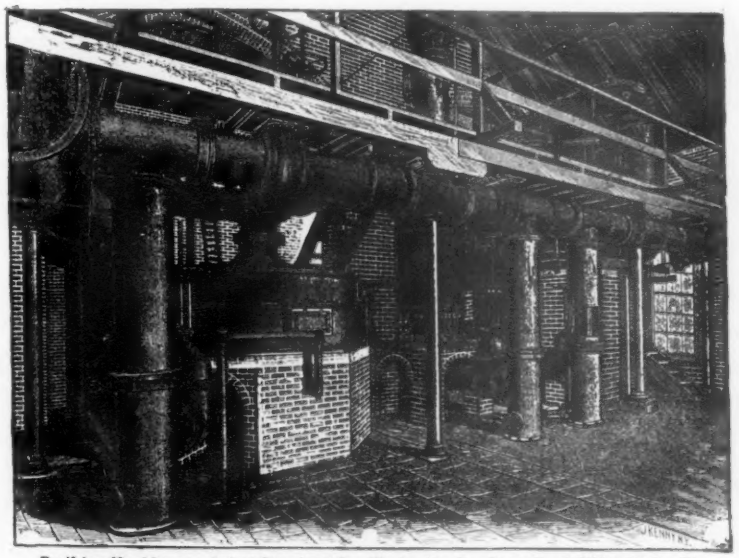

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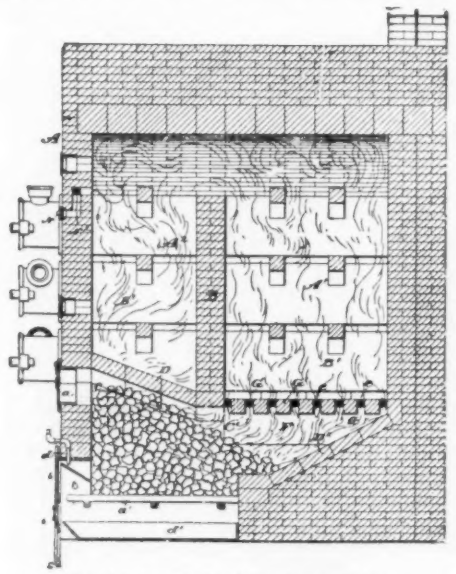

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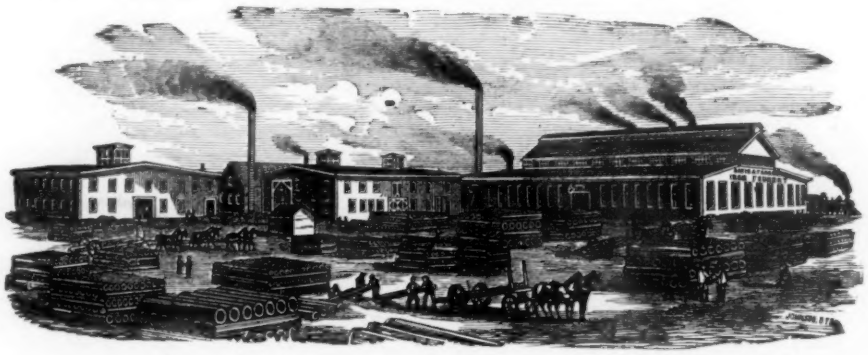

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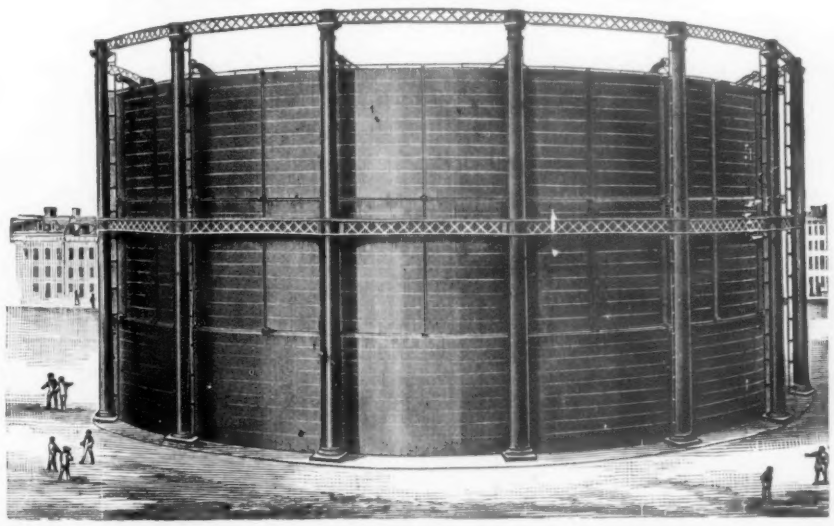

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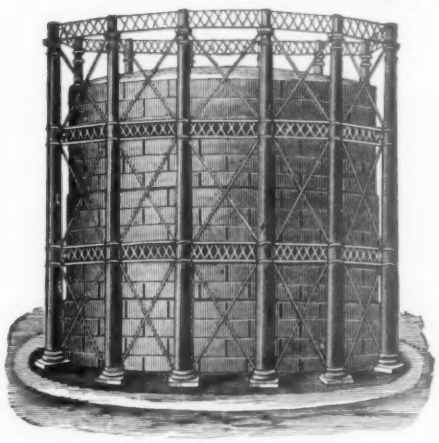

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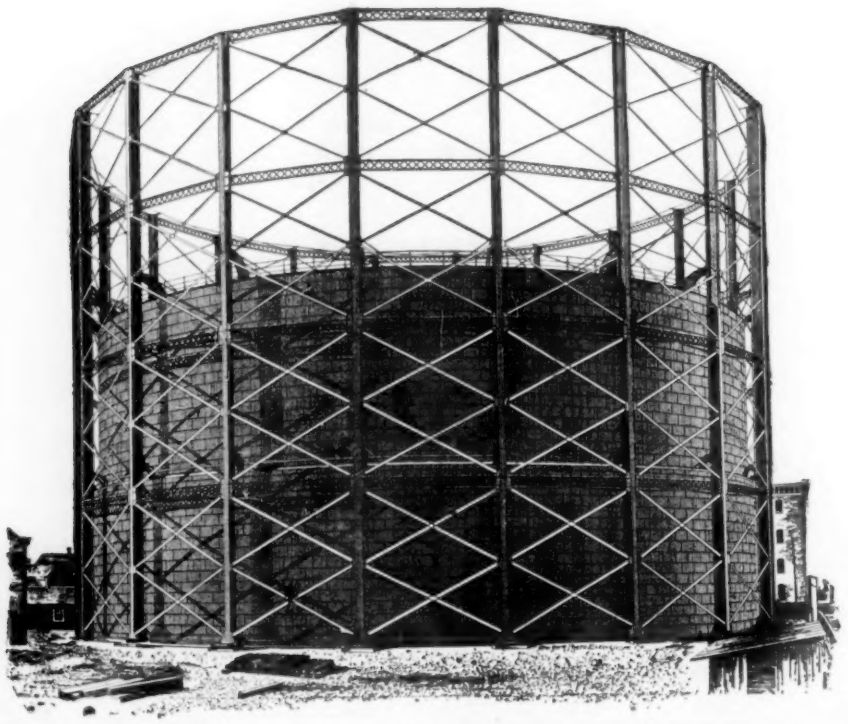

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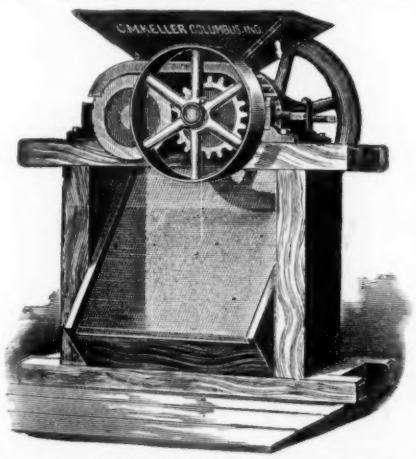

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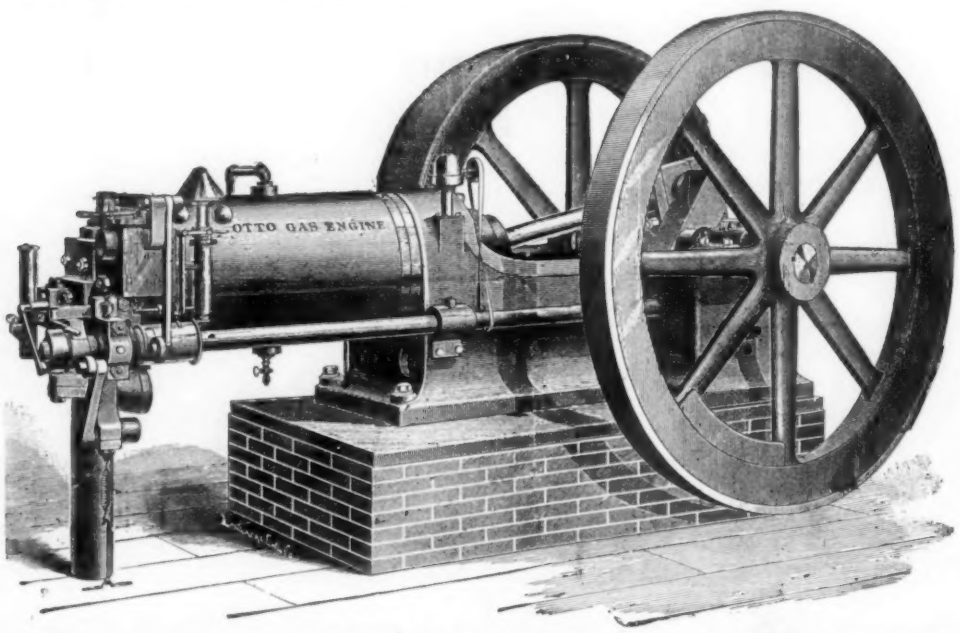

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